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Engineering Record

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A Vote for Unity

THE American Society of Civil Engineers will move its headquarters to the Engineering Societies Building; all the great national engineering societies will soon be under one roof. This is the significant announcement made this week at the annual convention of the American Society of Civil Engineers. By a vote of 2500 to 390 the members expressed their desire to move. When all the circumstances are taken into consideration—the sacrifice of its independent home and the turning of the two to one adverse majority of twelve years ago into a six to one favorable vote now—it is apparent that some very deep feeling stirred the members. True it is that some conditions have changed; the joint housing is no longer an experiment; the disparity in the relative standing of the societies has disappeared; and the financial strength of the Thirty-ninth Street organization is undoubted. But these changed conditions alone could not have brought such a reversal of feeling among the members of the American Society of Civil Engineers. Some deeper motive was stirring and that motive was the desire for professional unity. The profession, generally, feels that on the big questions which affect the welfare of the engineer or that bear on civic problems of an engineering character all engineers must act together. There must not be civil and electrical and mechanical and mining engineers, but just engineers. And this unity of action, those who voted favorably believe, will be furthered by physical proximity. The separate societies will continue separate. Their identity will not be impaired, but where joint action is needed, there will be joint action. The vote just counted is a clear direction by the civil engineers to the officers of the society to bear well their part whenever co-operation will properly serve the ends of the profession and of the public. The future is rich in promises of great results from the momentous step that has been taken.

The Subsurface Hydrant

IN his report on city planning and its relation to waterworks design, presented recently at the convention of the American Waterworks Association in New York City, E. P. Goodrich gave the results of a questionnaire on the subject of underground water hydrants. Reduced to its simplest terms the case of the subsurface hydrant may be stated thus: It is regarded with distrust by those who have not used it and is in high favor with those who have. This summary of opinion is highly significant and it prompts the question, "Is there not a wider field of usefulness for the hydrant located underground?" Its chief disadvantage, as compared with the post hydrant, is that it is difficult to locate during winter, when the ground is covered with snow and ice. This objection, however, would not apply under conditions which exist in many of the Pacific Coast and Southern cities. As Allen Hazen pointed out in discussing the report, there is a field for study here by American manufacturers. No United States firm, he said, is manufacturing a subsurface hydrant at the present time.

Pay for Guardsmen

IN announcing its decision to continue the payment of regular salaries to its employees who are now members of the National Guard or Naval Reserve and who have been called into the service of the United States, the McGraw Publishing Company, Inc., is merely embodying in concrete form one feature of the policy of national defense which has been advocated so strongly and so frequently in the columns of the Engineering Record. The ruling, which takes effect this week, applies not only to the Engineering Record's editorial and business staffs, but to all of the papers issued by the McGraw Publishing Company—*Electrical World, Electric Railway Journal, Metallurgical and Chemical Engineering*, and the new paper, *Electrical Merchandising*, which will make its initial appearance next week. Members of this organization, affected by this order, will, insofar as possible, be retained on the payroll and returned to the positions they now occupy when the need for their military services has ceased. The company has preached the military obligations of citizenship. It is now prepared to practise them by placing no restrictions upon members of its staff who wish to serve their country.

State and Federal Control

EVIDENCE of the growing realization of the folly of our present dual system of regulating interstate railroads is shown in the recent declarations of the platforms of two of the political parties. One of these declares as follows: "The entire transportation system of the country has become essentially national. We therefore favor such action by legislation—or, if necessary, through an amendment to the Constitution of the United States—as will result in placing it under exclusive federal control." Apparently the time is approaching when the wasteful necessity for the railroads of meeting the various requirements of state legislatures and tribunals, the discrimination forced by certain states, the square collisions between state and national authority, will end, and one public power will have the sole right to define good and bad, safe and dangerous, commendable and criminal railroad practice. Some of the politicians of the Middle West and elsewhere can be expected to fight hard for their football, but there is much encouragement in the declaration just quoted.

Compulsory Arbitration or a Strike?

AS WAS to be expected, little came of the recent conference in New York between the railroad managers and the representatives of the four brotherhoods. The latter refused to consider any line of wage revision that might reduce the present compensation of any trainman—in fact, adopted such an uncompromising attitude that there was slight chance for the conference to accomplish anything. Now the matter is in the hands of the employees, who are expected to decide by a vote whether or not there is to be a general strike of conductors, trainmen, enginemen and firemen—such a strike as the country never saw. It is time for the public to act. It ought not to be possible for any group of men, even so large a group as the membership of the four brotherhoods, to paralyze industry and force the railroads to pay $100,000,000 additional in wages, absolutely irrespective of whether they can earn it. Congress should act and compel the brotherhoods to submit the whole question, as the railroads have offered to do, to arbitration either by the Interstate Commerce Commission or under the Newlands Act, the former being preferable. Steps to make such arbitration automatic in the future could follow. The thing to be done now is to avert a strike—not by the usual method of surrender by the railroads, but by a fair trial of the case.

Federal Department of Public Works

MR. HERSCHEL'S presidential address before the American Society of Civil Engineers this week, printed in part on page 9 of this issue, makes a strong and convincing appeal for the formation of a federal department of public works. The countries of Continental Europe have demonstrated the wisdom of such a department. Their engineers, in consequence, occupy a very important place in governmental affairs. Despite all the arguments that can be advanced in favor of such a department and the commissioning of engineers, as army officers are commissioned, no results can be expected until strong pressure is brought to bear on Congress. When the engineers of the country can present a united front on the question, 30,000 strong in the national body, backed up by all the strength of local societies from coast to coast, which are in a position to impress their views individually on their congressmen and senators, results can be expected; but not before. Without a doubt the standing of the profession as a whole would be enhanced in this country if all the engineering work of the government were placed under such a department. The question is a good one for the consideration of the joint conference committee of the national societies.

The Work of the 22d Engineers at Camp Whitman

ENGINEERS who have been attending the many military lecture courses held in the principal cities throughout the country this winter have an opportunity of learning, from the leading article in this week's issue, how the theories which they have been studying have been carried out in actual practice. When President Wilson sounded his call for the mobilization of all National Guard forces the 22d Corps of Engineers of New York was rushed to Camp Whitman to prepare the 825-acre state-owned tract for the incoming troops of the division. A reading of Mr. Tomlin's article will indicate that the work preparatory to the assemblage of a large military force is, essentially, an engineering job.

There is, first of all, the transportation problem, involving, in the case of the little railway station at Green Haven, N. Y., the construction of extra sidings and unloading platforms. At the camp proper the big problem was the water supply. The alternatives were a ground water supply from deep wells or a surface water supply from Fishkill Creek, the latter involving a long pipe line and the installation of a chlorine-sterilization plant. Another big task was the mapping of the camp area so that space might be definitely assigned to the arriving regiments and information collected to guide the plan of tactical operations on a large scale. For this work the regular military sketching board or plane-table proved invaluable, and one of the novelties of the work was the use of thin sheets of celluloid, instead of drawing paper, in order that operations might be carried on during the heaviest rain without ruining the work. These and similar problems of an engineering nature demanded immediate solution before the camp could be declared ready to receive additional troops.

Never before, it is believed, has a civil engineering journal sent a staff correspondent to report the activities of military forces. The Engineering Record believes, however, that during the past year there has arisen among technical men a demand for information along military engineering lines. Acting upon this assumption this journal is able to present to its readers, at first hand, the news, from the engineering point of view, of the greatest mobilization of state forces in the history of the country.

Oregon Water Law Upheld by Supreme Court

OREGON'S water law, which has done so much to settle economically and finally water titles in that state, has been upheld by the United States Supreme Court. While being of the greatest moment to Oregon, the decree has only slightly less importance to the entire arid West. Particularly will engineers be interested in the decision. Not only does it directly affect works with which they are intimately connected, but confirms procedure by boards composed of or entirely dependent on engineers.

The Oregon water law, passed in 1909 and amended in 1913, was described by the state engineer of Oregon, John H. Lewis, in the Engineering Record, July 15, 1911, page 69. It provides a comprehensive scheme for securing an economical, orderly and equitable distribution of the waters among those entitled to their use, incidentally prescribing a mode of determining the relative rights of the various claimants to the waters of each stream, and in large measure commits the administration of the streams to the state water board and officers acting under its supervision. When one or more users of water from any stream make the request, the board, if it finds that conditions justify it, is required to set in motion a proceeding looking to an ascertainment and adjudication of *all* rights to the waters of that stream. Every material step in the proceeding is attended with notice and an opportunity to be heard. Each claimant is required to present a sworn statement of his claim to the board. Its nature, inception, extent and all the particulars upon which it is based must be given. These statements are open to public inspection, so that every claimant may determine whether there is reason for him to oppose or contest the claims of others. The state engineer, or a qualified assistant, measures the flow of the stream, the carrying capacity of the several ditches taking water therefrom, and the land irrigated or susceptible of irrigation from each ditch, and also takes such other observations as may be essential to a proper understanding of the claims involved. A report of all this is made in writing. A claimant desiring to contest the claim of another must present the grounds for his contest to the division superintendent and obtain a hearing before that officer, at which the parties may present whatever evidence they have and may secure the attendance of witnesses by compulsory process. After the evidence in the contest is taken, it and the sworn statement of the several claimants, with the report of the engineer's measurements and observations, are laid before the board. A finding of facts is made, an order entered embodying the findings and provisionally determining the relative rights of the several claimants, and the evidence and copy of the order transmitted to the circuit court of the county wherein the stream or some part of it lies. Exceptions to the board's findings and order may be presented to the court and the court then proceeds in accordance with the practice prevailing in suits in equity. The court may order the taking of further evidence by the board or may re-examine the whole matter itself, all parties in interest being fully heard. The court then enters a decree as the law and evidence may require, whether it be an affirmance or a modification of the board's order. Appeal may be taken to the supreme court of the state. When the rights are finally adjudicated each claimant receives from the board a certificate setting forth the priority, extent and purpose of his right, and, if it be for irrigation purposes, a description of the land to which it is appurtenant.

The law was attacked in the case just decided principally on points of legal practice, though it was also contended that the law is in contravention of the fourteenth amendment of the federal constitution. The case was that of the Pacific Live Stock Company vs. Lewis et al.

The purely technical grounds are of very little interest to engineers. In his contention that the law is repugnant to the fourteenth amendment of the constitution the plaintiff claimed that it contravened his right because it required a claimant, at his own expense, to assert and prove his claim before the board and to pay an extortionate fee for having it considered—all under penalty of forfeiting his claim if he refuses—notwithstanding that the board acts only administratively and its finding and order are not conclusive. The plaintiff also maintained that repugnance existed because the board accepted sworn statements of claimants taken ex parte, without affording opportunity to ascertain their true value by cross-examination or otherwise, and finally because the board's finding and order must be followed and given effect in the distribution of the water pending the action of the circuit court upon them.

On all of these points the Supreme Court disagrees with the plaintiff. The court holds that the fee of 15 cents per acre for the first 100 acres, 5 cents for the next 900 acres and 1 cent per acre for any excess over 1000 acres is not extortionate and unreasonable. It quotes with approval an opinion of the Supreme Court of Oregon saying: "That these services are beneficial to the claimant and necessary to the preservation of his rights in the stream and the protection and assurance of his title goes without saying." Regarding the ex-parte testimony accepted without cross-examination or other ascertainment of its worth, Judge Van Deventer points out that the records at every stage in the proceedings are open to public inspection and that the entire matter is reviewable by the court, all parties in interest being heard. On the distribution of waters in conformity with the board's order, pending the adjudication by the court, the Supreme Court holds that there are many precedents in congressional and state legislation for this procedure.

On every point, therefore, on which the law was attacked the Supreme Court has ruled against the plaintiff. Those responsible for framing the Oregon statute have every reason to be satisfied with the results of the contest. While there may be other points on which the measure may be attacked, it is hardly likely that any promising arguments were omitted in the present issue. The statute has been of immeasurable value to Oregon, and close approximations to it in other arid states have given excellent satisfaction. Engineers have long contended that litigation would be saved were the technical advisers allowed to reach a determination as to the engineering facts. The demonstration of the effectiveness of the procedure has been conclusive in Oregon, and it is a satisfaction to know that the statute under which the procedure is carried on has now been confirmed.

Standard Units for Municipal Work

MAYORS and other officials of cities in New York State, assembled in annual conference early last month, will serve the interests of their taxpayers, as well as the engineering profession at large, by ordering the adoption of the standard units for comparing municipal work recommended in an address by A. Prescott Folwell, chairman of the committee on standard forms of the American Society of Municipal Improvements. Some of the absurdities occasioned by the present lack of uniformity in methods of reporting costs of work were well illustrated by cases cited from the pavement field.

In spite of the fact that sheet asphalt construction is pretty well standardized, one city reported a cost as low as $1.25 per square yard, while another showed an expense of $3.53 for the same type of construction. In one case the cost represents actual paving, while in the other are included, in addition to the pavement proper, such items as grading, setting new curbs, laying drains and resetting manhole heads. Of course, without detailed explanation, such figures are absolutely worthless as a basis for comparison.

Mr. Folwell's committee is endeavoring to make the term "cost of pavement" mean just one thing—the wearing surface down to the base, if any. It does include the cushion or binder course. The unit recommended is the square yard, accompanied by a statement giving the thickness of pavement. Other items of expense, the committee maintains, should be classified under their proper headings—such as base, excavation, embankment, curb, gutter, sidewalk and sidewalk base. It should not be necessary to urge upon engineers the desirability of uniform practice in this matter. Technically trained men, however, might advocate such standardization without making the force of their argument felt, but, coming from a mayor or other high city official, orders for preparing contracts and reporting costs on the basis of the recommendations of the American Society of Municipal Improvements would go into effect immediately and would have a far-reaching influence.

If the American Society of Municipal Improvements would confine its activities to constructive work of this sort, instead of making its meetings hotbeds of commercial discussion, it would reach a higher place in the minds of engineers.

Strength of Large-Size Columns

ALTHOUGH the slenderness ratios of the eighteen large columns tested in the 10,000,000-lb. testing machine at Pittsburgh are so low that these half-size models of heavy bridge chords must be classed as short struts, so that no conclusions regarding variation of column strength with slenderness are possible, there are two definite indications of importance noted in the results. As reported in the abstract of a report of these tests made to the director of the U. S. Bureau of Standards, printed on page 19 of this issue, the tests show that the strength of large built-up columns of low slenderness ratio is about equal to the yield point of the component steel, practically regardless of the composition of the material. This fact is unusually well demonstrated by the tests, in which five different alloy steels were used. For all twelve specimens which failed as a whole the ultimate strength lay between the minimum and maximum values for the yield points of the steel.

The second important fact, demonstrated by the local buckling failures of all the models of chords for the Memphis bridge, is the necessity for careful detailing of jaws and lacing. The value of the slenderness ratio for any short, separate, unsupported segment of a column should never exceed that of the column as a whole. Computation will show that for each of the four models which failed near the pin ends, the slenderness ratios of the jaw plates (based upon rectangular sections, neglecting small projecting angle legs) exceed that of the column as a whole, the excess being particularly marked for the carbon-steel models. Such unsupported jaws should be designed by an empirical "jaw thickness" formula which, though perhaps requiring excess material at the jaws, should insure column failure as a whole. It is good economy to add extra weight to details at such vital points.

One other less striking result of these tests is the influence of form of cross-section upon strength. By using thinner metal and greater distribution from the center of gravity, it was found that for all six comparison tests made on the Metropolis bridge chord models the strength in every case except one was somewhat increased.

These tests confirm the laws of strength for short struts and once more, as in the case of the Quebec bridge failure and subsequent tests, impressively emphasize the fact that ample end details and stiff unsupported elements between adequately laced points are of the utmost importance if the full column strength is to be developed. They furnish definite data to the designers and manufacturers of large bridges concerning the action under load and the relative strength of heavy built-up columns of various alloy steels. Nickel steel and Mayari steel show approximately equal ultimate strength, consistently exceeding the values for silicon, chrome and high-carbon steels.

Engineers and the New Nationalism

NEVER before in American engineering history has there been so widespread an interest as now in the relation which the engineer should bear to the community. National as well as local societies are seeing the obligation and the opportunity. What is more, they are discharging the one and seizing the other as never before. But not merely as independent bodies are they making themselves felt. The strength of co-operation is appreciated. On all sides are heard pleas for the unity of the profession in order that its influence and power may be increased. The overwhelming vote, commented on elsewhere in these columns, in favor of moving the headquarters of the American Society of Civil Engineers to Thirty-ninth Street is most striking evidence of this desire for professional unity.

While, therefore, the engineer is appreciating as never before his relations to the public good, it is doubtful whether he has grasped the significance of his position and opportunities as clearly as they are set forth in this issue by Miss Frances A. Kellor. In the article on the "Engineer and the New Nationalism," on page 12, she pictures the engineer as holding the pivotal position in the solution of the human problems—the greatest, she contends, in industry to-day. Her thorough familiarity with conditions among the working classes—with the relation which industry bears to these conditions and with the reaction, in turn, which these conditions and their results have on industry—gives her words an undisputed authority. Moreover, none can read her argument without admitting the truth of her conclusions.

Her thesis is that to develop a stable, competent labor force—to the end that America may be able to maintain her industrial supremacy—the incoming foreign labor and that already here must be Americanized as speedily as possible. "We can do this," she says, "by reducing uncertain elements in labor, by providing good conditions within the plant and outside, by having a common language, a common citizenship and one standard of living. We can do it by giving each workman a citizenship stake in America, a home stake in the town and an industrial stake in the plant. This is Americanization by industry, serving both the needs of industry and of citizenship." Manifestly the engineer with his supervision of municipal conditions—the laying out of towns, the provision of sanitary measures, etc.—has control of the material factors which affect and aid to effect this Americanization. That is just Miss Kellor's contention, and she pleads for a full recognition by the engineering profession of its responsibility and of its great opportunity.

A careful reading of Miss Kellor's article is urged upon every reader of the Engineering Record.

THE TENTS OF THE 22D CORPS OF ENGINEERS WERE THE FIRST ONES PITCHED AT CAMP WHITMAN

With the 22d Corps of Engineers at Camp Whitman

In Preparing for the Mobilization of the Entire National Guard of New York State Last Week the Engineers' Duties Included the Installation of a Water Supply, a Survey of the Camp Site, Mapping a 64-Square Mile Area for Tactical Operations and Constructing Aids to Transportation and Sanitary Works

By ROBERT K. TOMLIN, JR.
Managing Editor of The Engineering Record
Photos by the Author

UPON an 825-acre tract of rolling farmland up in Dutchess County, New York, a mile or more back from the little railroad station at Green Haven, a great tented city sprouted, mushroomlike, last week, almost before the echoes of President Wilson's orders for the mobilization of the nation's militia forces had died away. This was the answer of New York's 22d Corps of Engineers to the call for a camp to accommodate a full division of the National Guard. With transit, level, military plane-table and map-making equipment, car loads of pipe and lumber, well-drilling rigs, pumps and excavating tools, the state's military engineering forces, under the command of Lieut.-Col. Eugene Willett Van Court Lucas, West Point graduate and member of the American Society of Civil Engineers, have performed the miracle of preparing the huge tract covered by Camp Whitman at Beekman, N. Y., for the influx of 18,000 men, a number which will be considerably increased when the units of the division are recruited to war strength. The intention last week was to mobilize all of the state's militia forces at Camp Whitman, but recent changes in orders indicate that some of the units provided for at the camp will proceed from their armories direct to the Mexican border.

Early last week Camp Whitman was little more than a painted signpost at the edge of a hay field along the Pawling-Fishkill road. To-day it is a vast checkerboard of conical tents and company streets, laid out with the precision of a township survey and furrowed by trenches carrying water-supply pipe lines from tanks on a hill commanding the vast camp area. Sanitary conveniences have been installed and crematories built for the destruction of kitchen wastes. Every day since the command was ordered out survey parties have sallied forth, shortly after sunrise, to map a 64-square mile area which Major-Gen. John F. O'Ryan, commander-in-chief of New York State's forces, has designated for extended field maneuvers of the troops which are concentrating at Camp Whitman. The mapping of this extensive tract was well along toward completion at the end of last week. To the observer of activities at Camp Whitman since President Wilson's call to arms was sounded, one thing stands out clearly—

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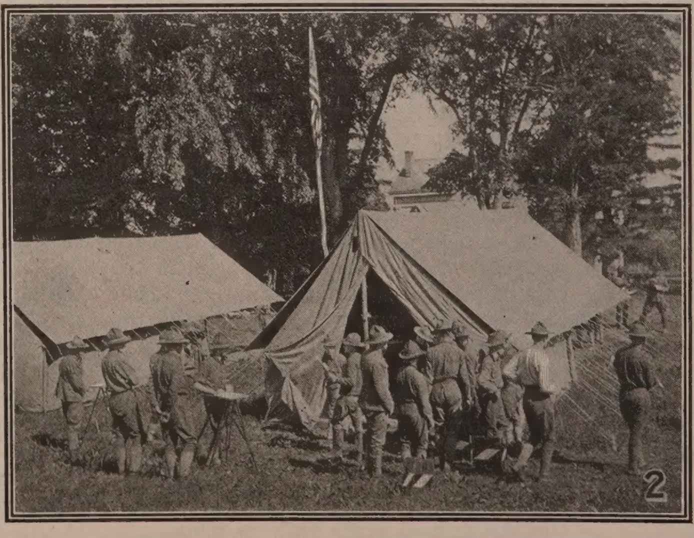

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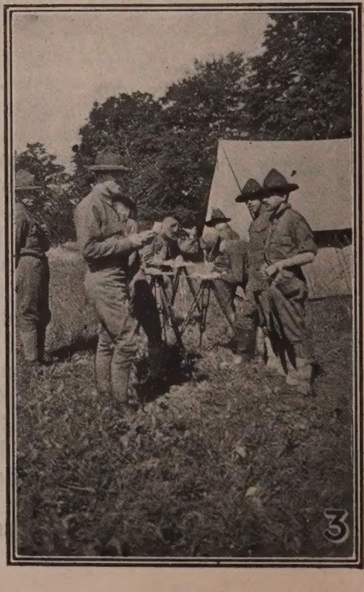

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1—MAKING ROAD SKETCH WITH ARMY PLANE-TABLE
2—SURVEY PARTIES AWAITING ASSIGNMENTS AT RECONNAISANCE TENT
3—READY FOR THE FIELD

the 22d Engineers have been the very backbone of the state-wide mobilization scheme.

A feature which should be noted at the outset is that the 22d Corps of Engineers was called upon to perform its task three weeks ahead of schedule time. It had been the intention to have a camp site ready for a portion of the State militia forces early in July, and a small detachment of the corps had been ordered to Camp Whitman in May to start preliminary work. But no contract of the size which actually developed when the general mobilization orders went out was ever anticipated. What has been accomplished in camp layout, topographical survey work, water supply, waste disposal and improvement of transportation facilities is a great tribute to the efficiency of Colonel Lucas and his men. Company D, commanded by Capt. Ernest F. Robinson, well known to New York engineers through his lecture on military preparedness, delivered recently before the American Society of Civil Engineers, and Company B, in charge of Capt. H. C. Woodward, were the first to arrive upon the scene on June 13. They were reinforced on the following day by the remaining six companies of the command, bringing the strength of the command to 715 officers and men.

WATER THE CRUCIAL PROBLEM

Without doubt the water supply was the most urgent problem which Colonel Lucas and his men were called upon to solve. Beekman, where Camp Whitman is located, is the epitome of the "one-horse town." It boasts about 100 inhabitants and a four-train-a-day railroad service. There is no public water supply. Wells at the widely scattered farmhouses are the only sources of drinking water. The situation at Camp Whitman, therefore, presented complexities not encountered at the federal mobilization camp in San Antonio, Texas, where, according to a statement made to me recently by Robert J. Harding, general manager of the local water company, it was possible to tap the city mains and conduct water to the encampment by lateral lines of pipe.

At Camp Whitman there was no existing local supply which could be adapted to camp needs. A new one had to be created. The alternatives were to sink wells or to pipe a supply from Fishkill Creek, which crosses the State-owned camp tract north of division headquarters. Preference was given by the engineer officers to the ground-water supply. It must be remembered that the area, when fully occupied, will contain at least 18,000 men at the outset, and to this number thousands more will be added when the division is recruited up to war strength. With this number concentrated within a comparatively small area on a watershed it was realized that there would always be a menace of pollution were a surface water supply, such as Fishkill Creek, chosen. The decision in favor of deep wells, therefore, was made, and rush orders were sent out to a couple of drilling contractors at Poughkeepsie, 18 miles away, to ship rigs and working crews to the site at once. The first man to arrive on the job was George M. Lyon, a well-drilling contractor of twenty years' experience, including work on the Catskill aqueduct for New York City's additional water supply. He was assigned to a low-lying area west of the center of the camp, and started work with a cable rig, chopping bit and sand bucket. Water was struck June 21 at a depth of 13 ft. at a point located between two rock outcrops, in what is known as the Hopewell basin. The first flow, however, was classified merely as surface water, and the drilling was continued in order to get into a water-bearing stratum of gravel and sand. Three wells had been put down at this site last week. At another location, northeast of the camp center, a second group of three wells was sunk, and with the yield from these it was hoped to have a supply sufficient for the needs of the incoming troops. On June 20 Fairbanks-Morse gasoline-driven engines and pumps were on the ground ready to be hooked up to the wells just as soon as they had reached a depth and gave promise of a flow satisfactory to the engineer officers.

The basis upon which the calculations were made for the necessary water supply was a consumption of about 25 gal. per capita per day, including water needed by animals. It was estimated that with the

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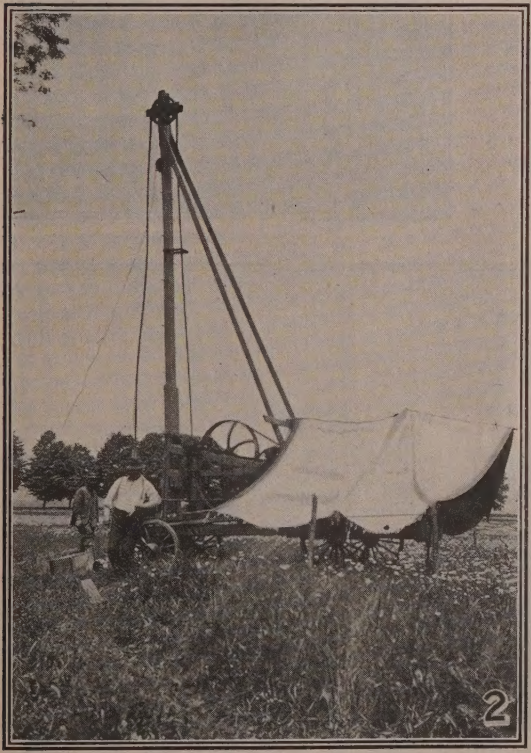
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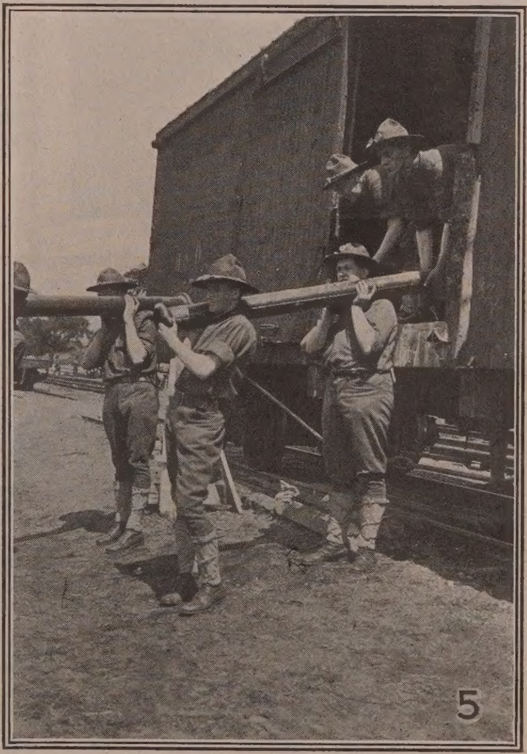
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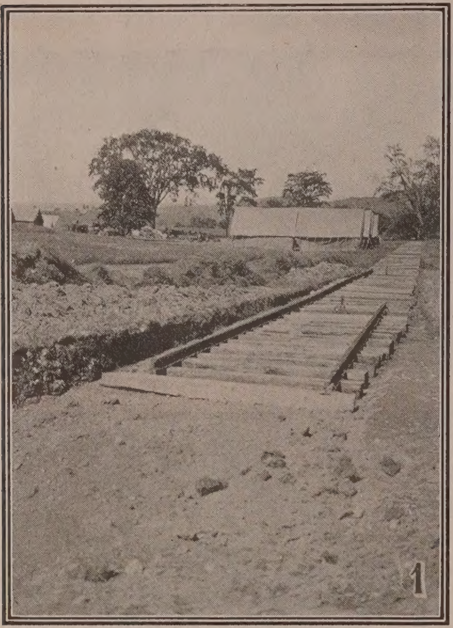
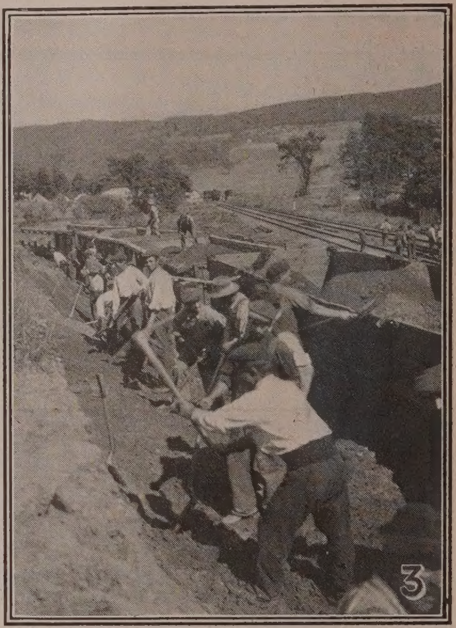
The Camp Water Supply

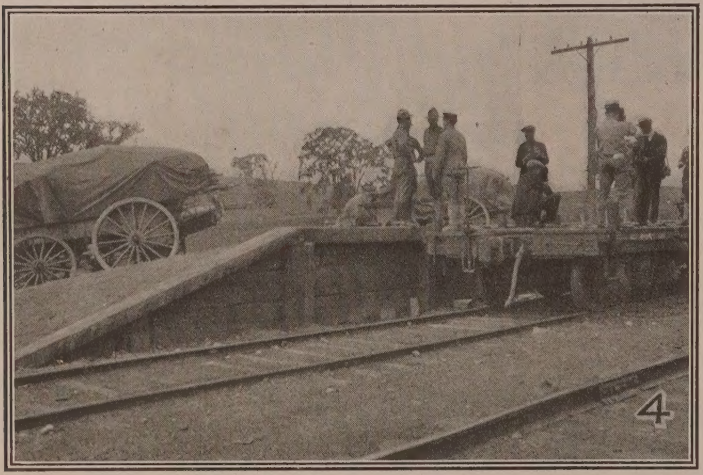
1—LOADING PIPE LENGTHS AT GREEN HAVEN STATION. 2—THE FIRST ATTEMPT TO SECURE A WATER SUPPLY WAS BY MEANS OF WELL-DRILLING RIGS. THE ALTERNATIVE PLAN CONTEMPLATED A SURFACE SUPPLY FROM FISHKILL CREEK. 3—LAYING 6-INCH PIPE LINE TO ELEVATED TANKS FROM WHICH DISTRIBUTION WILL BE MADE. 4—THIS WELL, FROM WHICH ALL CAMP WATER WAS FIRST DRAWN, WAS THE SUBJECT OF A SANITARY SURVEY. 5—DETAIL OF ENGINEERS UNLOADING FIRST CARLOAD OF WATER-SUPPLY PIPE camp fully occupied 500,000 gal. of water a day would be sufficient.

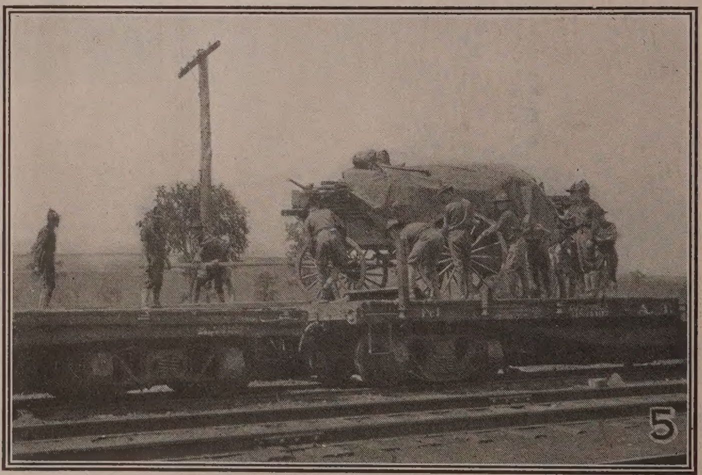
May Utilize Fishkill Creek and Sterilize Water with Chlorine

In the event of the wells failing to produce the necessary amount of water, the plan last week was to run a pipe line to Fishkill Creek and pump the water to camp. If this scheme is adopted all the surface water, before it reaches the men, will be passed through a sterilizing plant using liquid chlorine. Pending the final solution of the water problem last week, troops which were expected at the mobilization camp were held in their armories at New York City and elsewhere.









Aids to Transportation

1—SIDING TO QUARTERMASTER'S SUPPLY TENTS. 2—COMBAT WAGON LOADED WITH TOOLS AND EXPLOSIVES. 3—RAILWAY CREW CUTTING DOWN HILL FOR NEW TRACK NEAR CAMP. 4—PLATFORM AND RAMP BUILT BY A DETAIL OF ENGINEERS. 5—HOW THE NEW PLATFORM SIMPLIFIED THE REMOVAL OF WAGONS FROM FLAT CARS

The distribution of the water supply will be from a pair of 50,000-gal. elevated wooden tanks, supported on concrete foundations at the summit of a hill commanding the camp site. The plans call for a main girdling the camp area, with connections to each of the units of the division. Because of its ease in laying over rough ground, and the fact that it requires no lead calking, Universal cast-iron pipe was selected for the main arteries of the water supply system of Camp Whitman. The first of four carloads of pipe and fittings left the Central Foundry Company's shops the day after the contract was placed by Colonel Sternberger of the Quartermaster's Department. The pipe-laying work is being done entirely by militia forces. In the 69th Infantry a number of steamfitters and mechanics were discovered, and these men, working with the engineer troops, are laying the pipe lengths in plowed furrows, which are to be backfilled. The line leading uphill to the elevated tanks is 6 in. in diameter, the circuit main around camp 4 in., and the lateral lines 2 in., with ½-in. bib cocks at company streets.

There will be a pipe line with a tap at the head of every company street, where the kitchen is located. This means 14 taps to an infantry regiment, one for each of the twelve companies, one for the officers and one for the machine-gun detachment. Each regiment also will be provided with a bathhouse containing 14 shower heads. It is expected to deliver water under a head of about 60 ft. The complete supply will involve the laying of about 60,000 ft. of pipe ranging in size from 6 to ½-in.

The camp water-supply problem has been in the hands of Capt. Ernest F. Robinson and Lieut. J. E. Baker, reporting to Major William S. Conrow. Lieutenant Baker in civil life is employed on the engineering staff of Westinghouse Church Kerr & Company, of New York City. This firm has placed the resources of its purchasing and other departments at the disposal of the water-supply engineers at Camp Whitman, and as a result supplies needed in a hurry can be telephoned for and delivered promptly on the work. This co-operation, it is stated, has been of invaluable assistance in expediting the work. At Camp Whitman Lieut. M. H. Gray has been in charge of the receipt and disbursement of supplies for the 22d Engineers.

Sanitary Survey Made

One incident in connection with the water supply demonstrates the ability of the 22d Corps of Engineers to cope with special problems. Last week the troops were obtaining all their drinking water from a well at the Owsley homestead, just across the street from division headquarters. Colonel Lucas wished to be absolutely sure that this source was safe, and he sent out a call to his company commanders for a man who could make a sanitary survey. Captain Robinson, of Company D, recommended for this work Private Nabstedt, an engineer who has had considerable experience in water supply and sewage work. He was detailed to make a thorough examination of the site, and in a four-page technical report, accompanied by a map drawn to scale, he indicated all possible sources of pollution at the well, and made recommendations for their prevention. Samples of the water were carefully taken and shipped to New York for analysis. Private Nabstedt recommended that the area in the vicinity of the well be disinfected, that the water be drawn, by means of a short length of pipe and a three-way valve, at a point some distance from the pump—so as to reduce the possibility of débris falling into the water—

and that a guard be stationed at the well to inforce the sanitary regulations prescribed. Colonel Lucus promptly issued orders based on these recommendations. Thus work which, in civil practice, would call for the services of a consulting engineer, was done by a member from the ranks of the 22d Engineers.

That the water supply has been the crux of the mobilization problem is apparent from what Colonel Lucus told me last week. "We have six wells down," he said, "but are having some trouble with fine sand. Our well points and screens have been delivered and they will be placed just as soon as we are satisfied that we have reached a plentiful supply of pure water. It is not possible to predict exactly when the wells will be connected with the pumps, but we expect to be delivering a flow into the pipe lines within a few days.

LIEUT. J. E. BAKER, DETAILED TO WATER-SUPPLY WORK

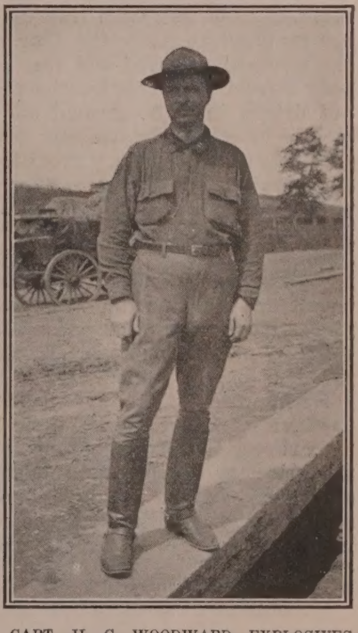
LIEUT.-COL. EUGENE WILLETT VAN COURT LUCAS, COMMANDING THE 22D CORPS OF ENGINEERS AND CHIEF ENGINEER OF THE NEW YORK STATE MILITIA DIVISION

Upon him rested the responsibility of getting Camp Whitman ready as a mobilization site for the entire National Guard of New York State.

MAJOR W. S. CONROW, IN CHARGE OF CAMP WATERWORKS

CAPT. ERNEST F. ROBINSON, WHO SUPERVISED CAMP LAYOUT AND WATERWORKS INSTALLATION

COLONEL LUCAS READS THE ORDERS OF THE DAY TO THE COMMISSIONED OFFICERS OF THE COMPANIES OF HIS COMMAND ASSEMBLED AT DIVISION HEADQUARTERS TENT LAST WEEK

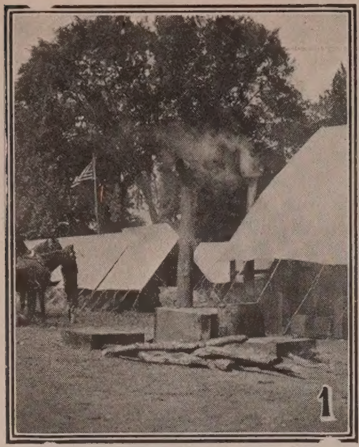


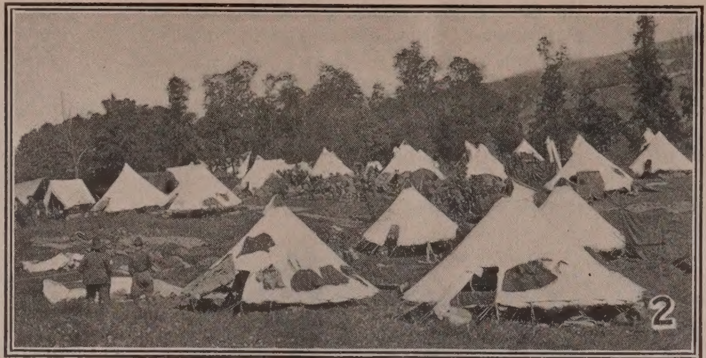
CAPT. H. C. WOODWARD, EXPLOSIVES EXPERT AND BUILDER OF AIDS TO TRANSPORTATION

"It must be remembered that in this work we have been jumped three weeks ahead of schedule, which called for the completion of the camp site July 9. With the arrival of the 69th Regiment we will be able to secure a number of steamfitters and mechanics to help on the work of laying the pipe lines. Our present water supply is sufficient for the troops now in camp—the 22d Corps of Engineers and the 69th Regiment. No more regiments will be ordered to Camp Whitman until the adequacy of the water supply is assured. Our two wooden water tanks, each of 50,000 gal. capacity, are reported to be at the railroad station at Beacon.

"Lack of transportation facilities has been one of our biggest handicaps, although within a day or so we will have available ten motor trucks and a number of draft horses."

Vying in importance with the water supply is the work of castramentation, or the laying out of the camp site and the assignment of definite ground areas to the troops of the division. This work was finished last week under the direction of Lieutenant Stockwell of Company F. The fields surrounding the camp were teeming with survey parties operating transit and stadia and plane-table. The job for which the survey parties are responsible is the assignment and marking of camp locations for the following organizations of the division: Headquarters Division, 22d Corps of Engineers, Signal Corps, Armored Motor Car Battery, Adjutant General and Pay Department, 1st and 2d Field Hospitals, 1st, 2d, 3d and 4th Ambulance Companies, 1st Cavalry, Squadron A, 1st and 2d Field Artillery. Then there are the following infantry units, nine of which will be chosen for the division: First Brigade Headquarters, and 7th, 71st, 12th and 69th Regiments; Second Brigade Headquarters and 23d, 14th and 47th Regiments; Third Brigade Headquarters and 1st, 2d and 10th Regiments; Fourth Brigade Headquarters and 3d, 65th and 74th Regiments. Then, too, provision has been made for the Quar-





Sanitation at Camp Whitman

1—COOK TENT HAS SIDE WALLS OF WIRE SCREENS. 2—CLOTHING AND BEDDING ARE AIRED EVERY MORNING. 3—CONSTRUCTION OF A MODEL CREMATORY FOR DESTRUCTION OF KITCHEN WASTES — STONES HEATED BY FIRE BUILT ON THEM EVAPORATE ALL LIQUIDS

termaster's Department, storage tents, corrals, wagon trains and commissary. Information about the topographical features of the tract is collected by the field parties, assembled upon a large map, and space then is assigned to each regiment or other unit. The field men have been instructed to mark with particular care all low spots, wooded areas unsuitable for tent pitching, stone walls and fences, and fields under cultivation. The main map of the camp site is on a scale of 200 ft. to the inch, with a 10-ft. contour interval.

There is a standard arrangement of the units in an infantry regiment which is followed just as closely as the configuration of the terrain will permit. The ideal encampment plan is shown in the accompanying sketch. It will be noted that a regiment of infantry occupies an area of 900 ft. long and 700 ft. wide.

With the topographical data available on the main map, areas are assigned to each regiment, and men with transit and stakes are sent out to mark the four corners of the plot and the head and rear of all company streets. At these locations long stakes are driven into the ground and are used by the company commanders for aligning the tents of their men. Provision is made along each company street for 18 squad tents, and in addition to the twelve companies of each infantry regiment there are lines of tents for the headquarters company and sanitary detachment, and for the supply and machine-gun company. The engineer troops also mark the location of the company officers' quarters and the line for the field officers' tents.

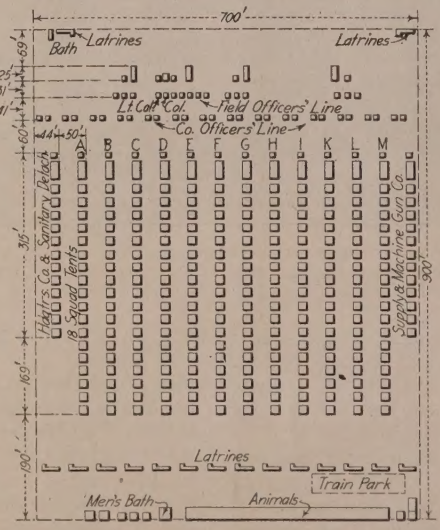
When word was received last week that the 69th Regiment had left New York June 21, a survey squad was sent out to designate the space for its encampment, and the last stake was driven, during a driving rainstorm, just as the head of the column appeared along the road from the Green Haven Station.

Map for Tactical Operations

Differentiated from the precise survey of the camp site is the task of mapping an area of 64 square miles in the vicinity of Beekman for tactical operations, practice marches and maneuvers in extended order. If time permits, it is the intention of the State military authorities to give the men thorough practice in the field, and it was essential, therefore, to know in detail the locations of all roads, cultivated fields, hills, farmhouses, fences, ponds, etc., in order that problems in attack and defense could be intelligently planned. To secure this information Lieut. H. L. Mellen of Company D, an engineer graduate of Columbia University, has had about 20 or 30 sketching-board parties in the field, and it was expected to have all data ready for the final map last Saturday.

The sketching outfits used are of the regular army type, comprising a wooden board about 14 in. square, mounted upon a tripod with adjustable legs. Sights are taken along a ruler lying flat on the board, and all distances are paced. Speed, of course, is one of the essential requirements, and no chaining or taping is in evidence at Camp Whitman. The work which has been done with the sketching-board is spoken of as road mapping, and is plotted on a scale of 3 in. to a mile. Such features as fields, houses, stone walls, cultivated areas, woods, streams, etc., are marked upon the map. The work is done by running traverses along the road and then the fragmentary information from each party is turned in to Lieutenant Mellen at the reconnaissance tent, where it is co-ordinated and reduced, by tracing, to one large map. A surprising accuracy, considering the approximate methods employed, is reported for the closures of the traverses. It has not been uncommon for the survey parties to number 150 men. The best day's progress for one party on the road-sketching work has been made by Corporal O'Brien and Private Southard of Company C, who covered a distance of 14 miles.

In the reconnaissance work for the field maneuvers the maps of the U. S. Geological Survey proved invaluable as a control. The government's work, however, was on too small a scale for military use, but it served to indicate the general topographical features of the country and was employed in order to assign work, in specified sections, to the survey parties. In the first road maps which have been turned in, no attempt was made to get detailed topography. The prime object of these sheets was to show the road locations, fields, houses, etc. Later, if time is available, the topography will be filled in.



IDEAL ARRANGEMENT OF UNITS IN A REGIMENT OF INFANTRY

Plane-Tables Operated in Rain

When it began to rain on the afternoon of June 21 I decided to visit the reconnaissance tent, thinking that the stormy weather would drive the men under canvas and afford plenty of time for an interview about their work. I was surprised, therefore, on raising the flap of the reconnaissance tent to see one lone draftsman.

"What sort of maps are these men going to bring in after the paper has been rained on for two or three hours?" I asked.

"Rain doesn't make any difference in this work," he replied. "We are not using paper at all on our sketching-board, but specially prepared thin sheets of celluloid with a roughened surface on which rain has practically no effect. In fact, we tested the sheets by submerging them in a pan of water and making a sketch in pencil. There was no smudging. This sample of subaqueous draftsmanship convinced us that we had nothing to fear from the weather while our plane-table work was in progress."

Complete Drafting Room

Located just in back of Colonel Lucus' quarters, the "reconnaissance tent" is one of the camp features, from the engineering point of view. All the accessories of an up-to-date designing and drafting room are in evidence. The equipment includes two large drafting tables and two small tables, with T-squares, triangles, drafting instruments, tracing cloth and other equipment needed in map making. The tent is equipped with an acetylene light so that work may be done at night. The field equipment included a standard transit, a light mountain transit, a dumpy level, a plane-table and a score or more of military sketching-boards. The tent proper is continued by means of a canvas fly, under which are a long wooden table and seats for the use of computators.

Unloading Platform Built

The first engineering work I encountered upon arrival at Green Haven last week was a wooden bulkhead and earth platform and ramp which a detail, commanded by Captain

Woodward, had just completed to facilitate the unloading of supplies from cars. The structure consisted of a heavy timber bulkhead wall along the tracks, built to the height of the floor of a flat car. An earth-fill had been placed back of the wall, which was anchored to deadmen. Up to the time the engineer troops landed the Green Haven Railroad Station was totally unequipped to handle any large volume of freight.

Another important aid to the handling of supplies from the railroad cars was begun June 21, when two sidings were built from the tracks of the Central New England Railway into a field containing the storage tents of the Quartermaster's Department. The pictures show this work under way with forces recruited by the railroad company.

The wagon road between the Green Haven Station and Camp Whitman was in urgent need of repair to sustain the heavy motor-truck traffic and team haulage which will follow the complete occupation of the camp by the remaining troops of the division. Last week it had not been called upon to sustain any real heavy traffic, but during Wednesday's rain it was a mire of mud in many places. The engineer troops were planning to rebuild this important stretch of roadway just as soon as the camp layout and the water supply had been completed.

Urges Creation of National Public Works Bureau

Clemens Herschel Deplores Vesting of Control of Government Engineering Programs in Short-Lived Commissions

PREFACING his address with a reference to the great loss sustained by the American Society of Civil Engineers in the death of its president, Dr. Elmer L. Corthell, Clemens Herschel, who as ranking member of the society delivered the presidential address at the forty-eighth annual convention in Pittsburgh this week, urged the creation of a national department of public works. The states, he thought, should have similar departments, and in support of his view he pictured the ineffectiveness of "the commission habit in state government." Mr. Herschel also commended the decision of the society, as announced at the convention, to join the other national engineering societies at the Thirty-ninth Street Building in New York City. He thinks this is but a beginning, the end of which cannot be foretold.

Mr. Herschel said in part:

"We have had of late in the technical press and in the proceedings of engineering societies, ample evidence that the advancement of the profession of the civil engineer is a cause that still has the earnest attention of the large body of thoughtful working engineers of the country. The spirit of unrest has been abroad among them, and however much content with one's individual lot may be ethically or religiously proper, and bringing blessings in its train, yet is unrest in behalf of one's class, and an altruistic, lawful striving to better the lot of that class, a commendable, and perhaps the only effective means of achieving that end, as experience has amply shown. Engineers feel that they occupy a prominent place in the creation of the world's material welfare, and want a recognition of this fact —a recognition that a share in the world's honors is due them, in the minds and actions of their fellow-men. Especially is their unrest and a striving for increased public recognition justifiable and prominent among engineers, when the creation of state or public works is under consideration.

CONTROL OF PUBLIC WORKS

"Public works have been deemed the glory of long-established, or developed, states, since the dawn of history. To attempt to do without them, or to rely solely upon private enterprise to procure them, is a mere delusion; or notion; impracticable; and yet we have a national government and, generally speaking, forty-eight state governments, that make no permanent provision for their construction and upkeep, in their organic law.

"The expenditure of 4 per cent of the annual United States budget on public works is made the football of politics, and great is the cry of victory when this expenditure has been reduced to 3½ per cent.; but no word is heard about the other 96 or 96½ per cent of expenditure of the same budget; because public works are not recognized in the constitutions of the United States and of the states, to the extent of providing a department of the government, and permanent officers of the government, to construct and care for them. A large part of the lack of recognition of the civil engineer as a member of an honorable profession, and of his merits, is, in my belief, traceable to this very state of affairs.

"From time to time, the technical press contains discussions as to the anomalous position held by 'junior engineers,' and 'assistant engineers' in the service of the United States, on public works, in charge of the Corps of Engineers, U. S. Army; the former of whom can never rise above their basic position, and the best of whom consequently leave that kind of a service as quickly as circumstances will permit. These discussions are carried on in all sorts of tempers, and, to make my own temper clear in the matter, let me express the belief, founded on long personal observation and friendships, that there does not exist an abler, a finer body of men than this same Corps of Engineers, U. S. A. . . . The trouble is not there. It is because the whole system of carrying on the civil engineering works of the United States is an emergency makeshift; born of a denial of the propriety of the nation to build *any* civil engineering works, and of the necessity of building them, when their construction could no longer be avoided, by makeshift methods.

"Says Laurence Sterne, in his 'Sentimental Journey': 'They order this matter better in France.' And not only in France, but in every country of the globe, except in Great Britain and in the United States, the copyist of Great Britain, which the United States has been for so long and in so many directions. The first named, all have a ministry of public works, and, carrying on the business of this department, a corps of commissioned civil engineers. To that must the United States, and every state in the union, come, sooner or later. Commissions of laymen to rule in these matters, appointed as an emergency measure, are an anomaly in these days of a striving for efficiency.

HOW THE COMMISSION HABIT OPERATES

"Let me illustrate how the commission habit in state government operates, as philosophically viewed from a distance, in recent years. A certain state conceived the idea that it would be well to develop its principal seaport by works of the civil engineer. So a commission of laymen was immediately created to cause this to be done. The newspapers were replete for months as to who should be the chairman of this commission. There was a good salary attached. Not a word as to the civil engineer capable of designing the necessary works, and of wisely superintending the expenditure of millions of dollars in the future. Not one word.

"At length the die is cast, and the favorite of the 'plum-tree' enters upon a course of after-dinner speeches. After months of this sort of thing, and when the novelty of the situation has worn off, not much has been heard in the daily press as to the work to be done. An engineer has indeed been somehow appointed, and certain work planned and done. Then the former after-dinner speaker resigns, or is crowded out—it is immaterial which—changes of political government affect and debase the at-no-time illustrious commission and engineering corps, and the last end of that commission is worse than its inception—it is itself swallowed up and abolished in a reshuffling of the commissions of the state generally; and all this in the space of barely five years with the simultaneous hazard of millions of money to be expended, at once and in maintenance and repairs, or reconstruction in the future in a football game of politics.

COMMISSIONED CIVIL ENGINEERS NEEDED

"Is it not true, does one not see, in contemplating such bits of contemporaneous history, that especially in a republic are commissioned civil engineers needed for the proper carrying on of the public works of the state? The reason the average congressman, even the executive, respects the army engineer, as he does, is because the former knows that the services of the latter in and to the government will go on, when he himself will not unlikely have been wholly forgotten. He would equally respect the commissioned civil engineer.

"To illustrate again: Where else than in the United States would it have been possible for a dreamer of patriotic visions, in the service of the government, to have seen those visions come true under his able guidance in the space of some fifteen years, and at an expenditure of scores of millions of dollars; creating empires of arable land, where before was the desert; and after the threat of political removal by one brief layman incumbent of the chair at the head of his bureau, finally be made to succumb, without any justification that the public ever heard of, by another such brief incumbent, to the already manifested harm of the service, and of its future?

"No amateur ruling the immediate present, of an important government work and agency, should have such subversive powers of harm for their future. No matter even that he act from motives which to him at the moment seem wholly good. He may be mistaken. Certain it is that a system that enables a mere passing temporarily exalted incumbent of an office thus radically to disorganize, out of his own mere motion, a work of national usefulness and importance, is not for the good of the body politic.

A BEGINNING OF UNITED ACTION

"But the advancement of the profession of the civil engineer can be viewed from many another angle. We have, for instance, the work of combining the efforts of the various branches of the engineering profession, in matters of their common interest. According to section 2 of article II of our constitution, there are no engineers, except civil and military engineers, the original class distinction. But so various are to-day the occasions when it is necessary to apply 'the art of directing the great sources of power in Nature for the use and convenience of man,' that it long ago became impracticable to have all engineers in the United States enrolled in one American Society of Civil Engineers. Instead, we have the four prominent national engineering societies, and many amply useful, though less prominent, such engineering societies. And yet the number of their aggregate membership is small, compared with the population which they serve; a prominent reason why their expressed desires are too often but as a 'voice crying in the wilderness.'

"To remedy this condition which confronts us, many have labored, in season, and out of season, to bring about joint action of the engineers of the United States in matters of a common interest. This society has said that it believes in it, and as a step in that direction, as facilitating that sort of work, as a landmark and a beacon light to the public that engineers are at their posts of duty and should be recognized and reckoned with, we have said that the building of the four founder engineering societies on Thirty-ninth Street in the city of New York shall represent to the public, the home of a power in the land. The step we have taken and which has been voted in the affirmative, 2,500 for, 390 against, is of course but a beginning. It has been worked for in a duly humble spirit, and on the principle of doing one thing at a time, but the beneficent end of that work no man can see. 'Be of good comfort,' Master Ridley Latimer cried at the crackling of the flames, 'play the man! We shall this day light such a candle, by God's grace, as I trust shall never be put out.' Not only not put out, but increasing through the years, in effulgence, glory to the profession, and in usefulness."

What Is an Engineer?

Prof. C. R. Mann Reports That Canvass of Second Vote Raises Technique and Knowledge of Fundamentals to 25 Per Cent

TECHNICAL ABILITY, 25 per cent; human attributes, 75 per cent—these are the new ratings of the qualifications for success for engineers just given out by Prof. C. R. Mann of the Carnegie Foundation for the Advancement of Teaching. The figures are based on the votes received from the engineers asked to confirm or refute the percentages indicated by an earlier vote of a smaller number of engineers and announced last January at the annual meeting of the American Society of Civil Engineers. (See the Engineering Record of Jan. 22, page 125.) The new percentages were derived from 5441 votes. Professor Mann thinks the figures correspond to a rather definite ideal in the professional mind, one that can safely be made use of in testing and planning the work of the schools.

It will be recalled that in the ballot postcard sent out some months ago there were six groups of qualities, which were headed character, judgment, efficiency, understanding of men, knowledge of fundamentals and technique, and that the voter was requested to prefix numbers to the groups to show his estimate of their relative importance. Professor Mann's report states that differences in years of practice were found to make little difference in the vote. The votes placed the six groups in the order in which they appeared on the post-card, which is that of the table published in the Engineering Record. The report gives an extended table showing the percentage of the voters that placed each group above or below each other one. Representing the groups by their initial letters, C was held almost unanimously to outrank all of the others, the percentages so voting ranging from 85 per cent for C:J to 98 per cent for C:T. Similarly J was thought to outrank E, V and K by a slightly smaller percentage; a still smaller percentage placed E above U and K, and a bare majority favored U over K, while less than 15 per cent ranked T above any of the other groups.

CALCULATION OF RATINGS

The most probable values of the relative importance of these groups of qualities, states the report, were computed from these percentage votes by the method described in chapter 8 of Thorndike's "Theory of Mental and Social Measurements." These values are given in the first column of figures in the accompanying table. The last two columns give the values based on the first circular, and published in the Engineering Record of Jan. 22.

REVISED AND ORIGINAL RATINGS

	Revised		Original	
Character	24.0		41.0	
Judgment	19.5		17.5	
Efficiency	16.5		14.5	
Understanding of men	15.0		14.0	
		75		87
Knowledge of fundamentals	15.0		7.0	
Technique	10.0		6.0	
		25		13
		100		100

"When applying this definition to the schools," concludes the report, "it is desirable not to forget several perfectly obvious facts. In the first place, all the qualities mentioned are essential to genuine success, and conscious effort should be made to develop all of them as far as is possible. Second, character, initiative, common sense and qualities of this sort cannot be taught explicity like multiplication tables and rules of grammar. Third, education is a continuous process of growth, and therefore the conscious development of the qualities of the first four groups cannot to advantage be arrested for four years, even for the sake of a mastery of knowledge and technique. Fourth, the man whose character, judgment, efficiency and understanding of men have developed most during his college years has the best show after graduation, since these qualities constitute 75 per cent of his equipment. Fifth, the fact that character is rated at 24 per cent does not mean that an engineer can succeed with a 24 per cent character. It does mean that even a perfect character is but 24 per cent of the engineer's total equipment.

"With these facts in mind, it is evident that instruction in mathematics or machine design which aims only at a mastery of fundamental principles and technique cannot be nearly as efficient as instruction which, while paying due regard to technique and the mastery of principles, yet develops integrity, initiative, resourcefulness and common sense."

Supreme Court Confirms the Right to Levee Stream

Holds That Riparian Owner May Protect His Lands Even Though Such Protection Causes Damage to Other Owners

THAT the state levee boards and the Mississippi River Commission have the right to levee the Mississippi even though there be accidental damage to some owners of adjoining lands was the decision of the U. S. Supreme Court in an opinion (Cubbins vs. Mississippi River Commission et al.) handed down June 5, 1916. A certain Cubbins prayed for injunction perpetually prohibiting the levee boards from further building any levees, or strengthening and maintaining those now built. His grounds were that his lands had been subject to overflow and had thus been irreparably damaged; such damage, he contended, being a taking without compensation in violation of due process of law under the federal constitution, no offer having been made him for the lands damaged or proceedings taken to expropriate them.

Chief Justice White, who wrote the opinion—which was concurred in unanimously—set forth the main point at issue as follows:

"Its solution involves deciding whether the complainant as an owner of land fronting on the river had a right to complain of the building of levees along the banks of the river for the purpose of containing the water in times of flood within the river and preventing it from spreading out from the river into and over the alluvial valley through which the river flows to its destination in the gulf, even although it resulted that the effect of thus keeping the water within the river was by increasing its volume to so raise its level as to cause it to overflow the complainant's land."

TWO POSSIBLE VIEWS

The court stated that the question could be viewed from two angles—first, with reference to the rights of the land owners and the power of the state to deal with the subject; and second, with reference to the power of the United States under the constitutional provisions giving it control of improvements for navigation. The court found under the first heading ample authority to dispose of the issue, and the strength that might lie in its second method of approach was not requisitioned.

Reviewing briefly the Roman law of riparian rights, and the Code Napoleon, the court pointed out that while the free flow of water in rivers was secured from undue interruption and the respective riparian proprietors were protected from undue interference or burden created by obstructions to the flow or by deflections in the course, a limitation to the rule was also universally recognized by which individuals in case of accidental or extraordinary floods were entitled to erect such works as would protect them from the consequences of the flood, and that no other riparian owner was entitled to complain of such action upon the ground of injury inflicted thereby, because all, as a result of the accidental or extraordinary condition, were entitled to the enjoyment of the common right to construct works for their own protection. The court cites in support of its position numerous comments on the Code Napoleon and decisions of American tribunals to the same effect.

Special Plant Layout Expedites Construction of Brooklyn-Brighton Viaduct

Economy in Erection Increased by the Use of Adjustable Steel Arch Centering—Gantry Crane Places Heavy Sandstone Railing

ALTHOUGH handicapped by the necessity for constructing the Brooklyn-Brighton viaduct, Cleveland, in two sections, one half being first completed to allow traffic on the old viaduct to be diverted thereto, and the second half constructed after removal of the old, interfering structure, rapid erection progress was made through the use of a well-designed plant layout. Adjustable steel arch centering was found to be economical, the centers being constructed for one half the width and rolled laterally under the other half after the first was concreted. Owing to the large capacity of the mixing plant, due to efficient handling of materials, it is stated by the contractors that the whole bridge could have been completed in the time it actually required to build one half. The design of this bridge was described in the Engineering Record of June 24, page 832.

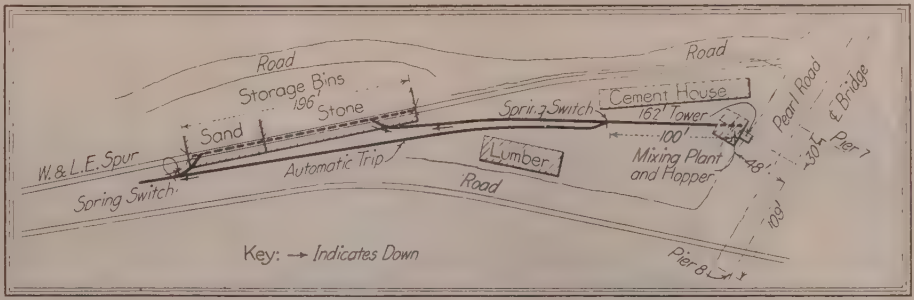
USE OF ADJUSTABLE ARCH CENTERS

One of the most economical features of the erection methods, which at the same time contributed largely to the rapidity of the concreting of the arched ribs, was the use of steel centering. As shown in one of the photographs, these three-hinged-arch steel centers were erected as braced units in two pairs of two each for the pair of ribs in one half of the roadway width. To the top chords were bolted 3 x 12-in. timber spiking pieces to take the 3-in. lagging, and the rectangular box for each rib was built in place. Centers for five arched spans were used, these being applied successively in the longer spans.

By using parts of these large centers and adding temporary members at the haunches, the centers were made for all remaining spans, except the three spans at each end. Timber centers were used for the three short spans at both the south and the north end, the centers for the two ribs being left in place until the first half of the viaduct was completed, and then rolled into position under the second half.

As the arch centers were not designed to carry more excess unbalanced weight of concrete than the weight of one panel, the spouting was arranged to insure alternate pouring on each side of the crown of the arch. The concrete was guided down the outside of the top lagging for the rib forms until it reached a hole cut just above the level to be filled. In this way the pouring was controlled and danger from excessive unbalanced weight avoided.

All the steel arch centers were supported on the reinforced-concrete coping at the springing line of the piers. They were rolled from the west to the east half in some cases. No centering supports were carried to the ground.



PLAN OF NORTH CONCRETE PLANT SHOWS HOW MATERIALS WERE HANDLED

The concreting of this long viaduct was accomplished by using two mixing plants and chuting from towers at these plants, using relay towers. They were located on railroad sidings, one on the Baltimore & Ohio Railroad and the other on the Wheeling & Lake Erie Railroad. The former fed one relay tower north and one south of the plant tower, while the latter fed one relay tower north of the plant tower. One of these plants, with its material storage yards, is shown in an accompanying photograph, and the scheme adopted for the rapid handling of materials is indicated in the drawing.

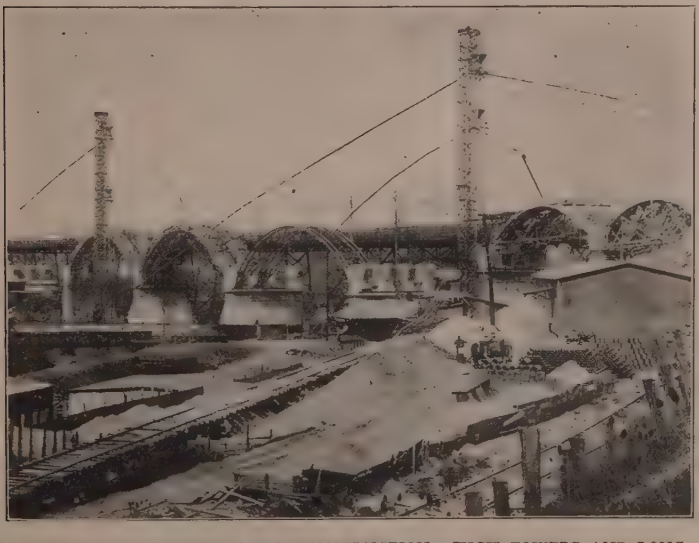
The aggregates were delivered in hopper-bottom cars run on the trestle shown and deposited in the material bin, while the cement was stored in a house located on the material spur and adjacent to the mixing plant. The material tracks were laid underneath these bins and 1½-yd. dump cars hauled by cables in two-car trains were loaded with the aggregates and hauled over the middle of the 70-yd. hopper above the mixer. A partition across the middle of this hopper separated the sand and stone supply, and the cars were dumped either to right or left, according to the material carried. The hoist then permitted the train to return by gravitation. The cable was automatically released at the bottom of the incline and the train was switched under the bins again and loaded.

The cement was wheeled to the mixer platform, at the level of the top of the charging hopper, by ordinary baggage trucks. The top of this charging hopper was below the material hopper or bin. The materials could thus be proportioned as desired when charging, the quantities of sand and stone being noted by the levels in the separate hoppers. A mix of 1:3:6 was used for the piers and abutments, 1:2½:5 for the retaining walls and 1:2:4 for the arch ribs, posts and floor system.

RAPID CONSTRUCTION PROGRESS

An especially good record for one mixer of 539 cu. yd. in one 9-hr. day was made on the work, but the average was about 50 yd. per hour while running. Owing to the small sections being concreted, it was rarely possible to continue running for a whole day; in one week, however, 2500 cu. yd. were placed.

While the work really began in September, 1914, only about 4000 cu. yd. were placed that year in footings and piers, so that the main structure has been erected since March 8, 1915, the date of starting



FIRST HALF OF ARCHES UNDER CONSTRUCTION—HIGH TOWERS AND LONG CHUTES DELIVER CONCRETE

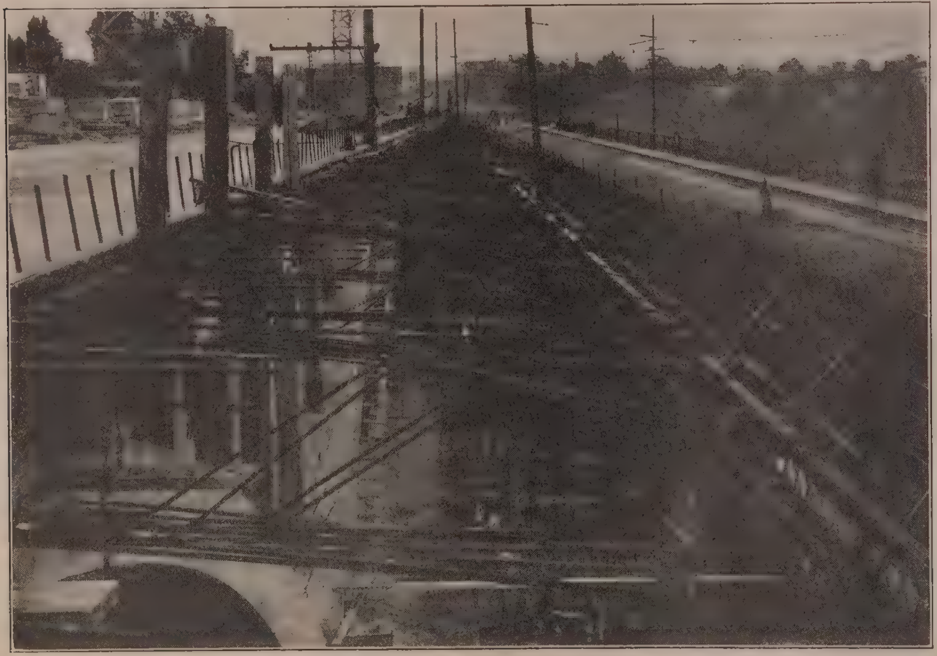
FIRST HALF COMPLETED—SIDEWALK SHELTER AT TOWERS FOR PROTECTION WHILE POURING OTHER HALF for the 1915 season. One half of the roadway for the whole length was complete July 21. It was then necessary to wait until the paving was finished and traffic transferred from the old viaduct to the completed half before the second half could be started. This caused the loss of over one month, until Aug. 25, and between Aug. 25 and Nov. 5 the second half was finished. The contractors state that they could have completed the whole bridge in practically the same time it took to build one half.

SURFACE FINISH—RAILING

All the exposed surfaces showing in the elevation of the bridge were rubbed by a wooden float in water as soon as the forms could be stripped. This was done within 24 hours in all cases where no loads were carried by the concrete. All the piers were rubbed in the same way up to the level of the springing lines of the arch ribs.

The solid paneled sandstone railing shown in one of the photographs is exceptionally heavy, containing nearly 5 cu. ft. per linear foot. It was handled by a gantry crane running on a temporary track on the roadway. The posts were first set in place over anchor rods, then the panels erected between them by doweling the various sections together.

The viaduct was built by Cuyahoga County, Ohio, after the design made under the direct supervision of A. W. Zesiger, bridge engineer, with W. A. Stinchcomb, county engineer. W. H. Baker was resident engineer for the county. The construction was carried out by the Bates & Rogers Construction Company, of Chicago, with C. S. Smith as resident superintendent.



FLOOR REINFORCEMENT FOR SECOND HALF PROJECTING FROM COMPLETED HALF

Old steel viaduct on right to be removed before second half is begun.

Concrete Paving Statistics

Statistics compiled by the Portland Cement Association show, by states, the number of square yards of concrete road, street and alley pavements in the United States which have been contracted for between Jan. 1 and June 1. The figures are: Roads, 6,066,204 sq. yd.; streets, 4,136,327 sq. yd.; alleys, 44,933 sq. yd.—a total of 10,247,465 sq. yd.

Engineers and the New Nationalism

The Great Industrial Problems To-day Are Human, Not Mechanical—Engineer's Position Puts Solution in His Hands

By FRANCES A. KELLOR
Assistant to Chairman, Immigration Committee, Chamber of Commerce of the U. S. A.

IN the selection of 30,000 engineers to take an inventory of industries, to serve as the basis for mobilization, the Naval Consulting Board is revealing the engineer as the future big civic factor in individual plants and as the foremost agent in the nationalization of business. This inventory will not only give the government information, it will give the engineer training and a vision of industrial organization and responsibility which he has but dimly realized as he struggled with world-wide problems in his corner of the plant.

When the industry was content with a "welfare" department or secretary for the benefit of its men, the social worker, the reformer, the misfit in regular departments, the outside agent, was placed in charge. The Safety-First movement, combined with first-aid work, spelled the doom of the irresponsible outside agent, and placed the engineer in the saddle. With the growth of functional management and scientific management, the engineer has become even more important. And now comes the call of the nation for the development of industrial resources and the conserving of materials. Already there are signs that this is but the beginning of national service for the engineer.

THE GREAT PROBLEMS

The great problems before industry today are not mechanical, but human—the conservation of men and the regularizing of industry, which will stabilize the labor supply. America is short of men. Many immigrants have returned to the home country; many others will go at the close of the war. Canada and South America are competing for immigrants. Canada is even now invading America to fill her vacant farms. We may be sure of one thing, industry cannot obtain workers after the war upon the same terms as before. Human beings have become more precious, and those in the trenches that return to hard labor will be less easily adjusted to peace conditions. The reserves in America to supply the existing demand are women. Many thousands of them have already been drawn into industry for the first time without adequate provisions for housing and protection being made for them—the usual wasteful American way. The other reserve is the negroes of the South, who are already being brought North to work on farms.

ADJUSTMENT NECESSARY

This again requires industrial and social adjustment, to which we have given but little thought. It is obvious to the industrial leader who is thinking about this problem that he must take steps to keep his men in the plant, to keep them in condition and contented with conditions. Immigrants have been given jobs in America, but little or no job stakes or home stakes. Many of them will not stay in America for high wages and short hours alone. They constitute the thousands of "birds of passage" that go back and forth between seasons in times of peace—with their labor power idle and their American wages to be spent elsewhere. It is not enough to keep men in condition and at work most of the time. The average labor turnover in America is about 200 per cent in the industries upon which America must primarily depend in time of war. In other words, for every 100 kept at work 300 are employed. This is sheer waste of men due to lack of combination in the regularizing of industry and employment of men.

In the past we have relied upon the economist and the professor to tell us about unemployment, irregularity of work, vocational education and similar industrial questions. The laboratory for study has been the employment agency and the lodging house, and the remedy—a law. In the future it will be the engineer who studies the problem in the plant, and the remedy will be the adoption of measures within industry itself which will make laws as unnecessary as they are useless to deal with such questions.

PROPOSED SOLUTION OF LABOR PROBLEM

America has to-day no system for distributing labor. We are trying to get it by establishing a Federal Bureau of Employment. It will succeed just in proportion as business uses it. We have for years witnessed "back-to-the-land movements," colonization schemes, land booms. They will succeed permanently only when industry establishes itself and furnishes jobs, and when agriculture organizes and obtains a system of rural credits enabling men to stay on the land until it becomes productive. We are building our distribution system without plans or specifications—a base here and a girder there, over which only an aeroplane could take us. When the engineer grapples with the problem of distribution he will give us a structure on which men can and will travel to work best suited to their needs.

There is no better illustration of the engineer's coming usefulness than in housing. We have long considered this a civic and welfare matter, but not as an industrial item, powerful in its influence to stabilize or disorganize the labor market. It is true that on a welfare basis corporations and employers can do and have done much in the way of providing "model housing" for a certain percentage of their men. But to provide adequate housing in a new community, or in a rapidly expanded old community, not only for a percentage of the higher-grade workmen, but for all the workmen in the plant, is plainly outside the welfare field.

This is true for two reasons. One of these is that workmen normally wish to have their own houses, arranging for renting or buying them on an independent basis. The second reason is that the houses that are built for several thousands of workmen are in the aggregate the making of a community, and it is in the nature of American character and institutions that the standards of that community should be controlled by the individuals that make it up. The standards they evolve may be better or worse than those that would be evolved for them by a kindly employer, but that the standards will belong to the men themselves —if the community is a creative and growing community and not merely an industrial camp—is proved by the whole industrial tradition of America.

THE ENGINEER THE REAL TOWN PLANNER

But even while this is true it is also true that the employer or the corporation which is responsible for the creation or expansion of a given town sets its housing and its community standards in the very beginning. Naturally, the employer's influence controls many of the things that are to determine the possibilities of the town. He may own or control the land around the factory, perhaps to the extent of half the town. He is probably a determining factor in transit facilities, water power, etc. Above all, he is the one man in the place who is in a position to map out the town with a view to both its industrial and its civic future.

Whether or not he has any aspirations to the office, he is the "town planner" by every implication of his position. His consulting engineer and the engineers that actually control the physical conditions in and around the plant are the real makers of the city or town that is to be. In a housing competition recently instituted, the chairman of the education committee of the special housing committee in charge of the contest is an engineer, and at least one-half of the committee are engineers. The conclusion of the whole matter is this: The engineer is the only man who can, in an expert way, translate the industrial-welfare movement into a sound industrial and community movement.

The model sanitary and housing conditions and much of the educational work on the aqueduct—the source of New York City's water supply—were in charge of engineers. We cannot import into a big construction project a committee of social workers or of social housing experts. Everything that is done in the way of housing the men and establishing standards in a community must be done with direct reference at every point to the actual project in hand. Only the engineer has his hand on every one of the considerations that must come into any plans that are made for housing or community existence.

ENGINEERS AND THE PUBLIC NEED

One of the most interesting aspects of the national-defense movement has been the way in which it has stirred various specialized groups in American life to see their work with reference to other groups and from a national perspective. The medical profession shows now, through its journals and through the utterances of various of its representatives, a distinct sense of its potential value as a profession in a national-reserve plan. Chemists, wireless operators, automobile manufacturers, etc., show the same realization. They show also a desire to put the realization into practical effect, and to be guided by it in such matters as making methods uniform, standardizing means of production, etc.—all with a view to efficiency from the point of view of the national need.

The enthusiasm with which engineers have taken up their work with the industrial preparedness committee of the Naval Consulting Board, and the evidence from the sub-committees in the different states of the business-like way in which the work is being carried out, testify to a keen interest on the part of the engineering profession as a whole in a piece of work whose significance to the profession is entirely new. *One of the great results which the work of the industrial preparedness committee will produce in the different states will be a body of engineers distinctly aroused to the economic and industrial needs of the country, as locally represented.* The information that these men will obtain, and the attitude which they undoubtedly will develop, will be a tremendous potential asset to the country. It should be used when the work of the industrial preparedness committee is done. In short, we want the engineers as a permanent economic and social reserve corps in a work that has long been needing their attention.

AMERICANIZATION

In the movement toward Americanization through industry, for instance, which is now sweeping the country, it is the engineer who must lead the way. Americanization is a practical matter. It is partly a matter of education, it is true, but in the industrial communities of the country the facilities for the education of immigrants are at this moment very largely determined *by the actual physical provision* in the way of schoolhouses and schoolrooms, the location of workmen's houses with reference to the schoolhouse or some other meeting place, etc. So far as housing standards, water provision, etc., go, the movement is entirely in the engineer's hands in the first instance, and there are not very many aspects of it in which he does not bear some part.

When the Safety-First movement became a campaign in need of organizing and standardizing, it was an engineer that shouldered the burden. We are now facing the vital need of conserving our labor supply, stabilizing the labor market and regularizing industry. The need to maintain our present output and to enable America to hold markets after the war is the need of a practical industrial conservation policy—a thing we have never had. Much of our trade energy must be given over to developing industries which have been created or fostered in this country by the war, and which must be retained if we are to maintain industrial independence.

ONE STANDARD OF LIVING

We must, therefore, conserve our present supply and plan to keep every resident in America. We can do this by reducing the uncertain element in labor by providing good conditions within the plant and outside, by having a common language, a common citizenship, and one standard of living in America. We can do it by giving each workman a citizenship stake in America— a home stake in the town and an industrial stake in the plant. This is Americanization by industry, serving both the need of industry and of citizenship. It is the engineer who goes first and helps build the plant. At the same time a beautiful, orderly, well-equipped plant is built and a new town started, equally good town planning must be done, and good housing, sanitation, transportation, etc., be provided—at the start. Men must be cared for *from the beginning*.

The Americanization pioneer in the new town is the engineer, and more and more there will fall to the young native-born engineer the task of preserving American traditions and standards and teaching them to strangers. Are our engineering courses that fit these young men taking into account the new responsibilities, and are they doing their share to fit the men for this national service? It would be well for the engineering profession to take stock of these new responsibilities and to see how well the engineering colleges and courses are designed to meet America's test of fitness.

Jealousy of State-Supported Schools Criticised

A. Lawrence Lowell Contrasts Harvard-Technology Co-operation with Rivalry of State Institutions

SPEAKING at the dedication of the new buildings of the Massachusetts Institute of Technology, June 14, President A. Lawrence Lowell of Harvard criticised the rivalry of State institutions drawing their funds from the one public treasury, and contrasted that rivalry with the co-operative plan worked out between Harvard and the Massachusetts Institute of Technology. He expanded also on the enduring nature of educational institutions, citing the histories of some of the world's great universities.

He spoke in part as follows:

DUTY OF PUBLIC SERVICE

"Of late years there has been an enlargement in our ideas of the duty of public service. Institutions of learning are not ends in themselves, but means to a greater end—that of the education and professional training of young men to fit them for their manifold work in the world. This is no less true of institutions endowed by private generosity than of those that are supported and managed by the state. Both are in equal degree public servants; both should have the same aims, duties and responsibilities. It is in this spirit that the Massachusetts Institute of Technology and Harvard University have agreed to co-operate in engineering and mining education, in order by so doing to render together a greater service to the public, in such form as the court may decide that we have a right to do it. By this spirit we have shown that we are more quick in our sense of public duty than some State institutions which, although paid from the same public treasury, maintain a needless rivalry at the public expense; while the general approval of our graduates shows that in their sojourn here they have been impressed with a larger sense of public service than those alumni of state institutions who have thwarted such a fruitful policy.

Most Enduring Human Creation

"The reward of public service is the opportunity for still greater service; and to the institution of learning that has used well and faithfully one talent, men will intrust the more. This has been our experience here in the past, and it will be so in the future. Men die and pass away, but these institutions remain, and our work here is not for ourselves but for them—the most lasting of all things. Forms of government change. Monarchies are replaced by republics, and these in turn decay. The boundaries of nations are removed; races melt away to re-form on different lines. But the University of Bologna has outlived all the small Italian republics—all the convulsions and transformations through which the country has passed—and stands erect to-day. The University of Paris has seen the expansion of the small monarchy over the whole territory of France, and has outlived it, and outlived many changes in the government.

"England has had a less checkered career, but one that has been less unshaken than that of Oxford or of Cambridge. From ten years after the settlement of Boston, throughout the times of the colony, the Revolution and the history of the United States, Harvard University has grown stronger and stronger on the banks of the Charles; and the Institute of Technology has existed for only one of the many half centuries to which we look forward with confidence. The most enduring human creation known to modern history is the institution of higher learning. It endures because it renders a public service with which the world cannot dispense."

NOT THE FULL HEIGHT OF THE FILL—ANOTHER TRESTLE ON TOP IS TO BE BURIED

185-Foot Fill of Bessemer & Lake Erie Railroad Reaches Beginning of Last Stage

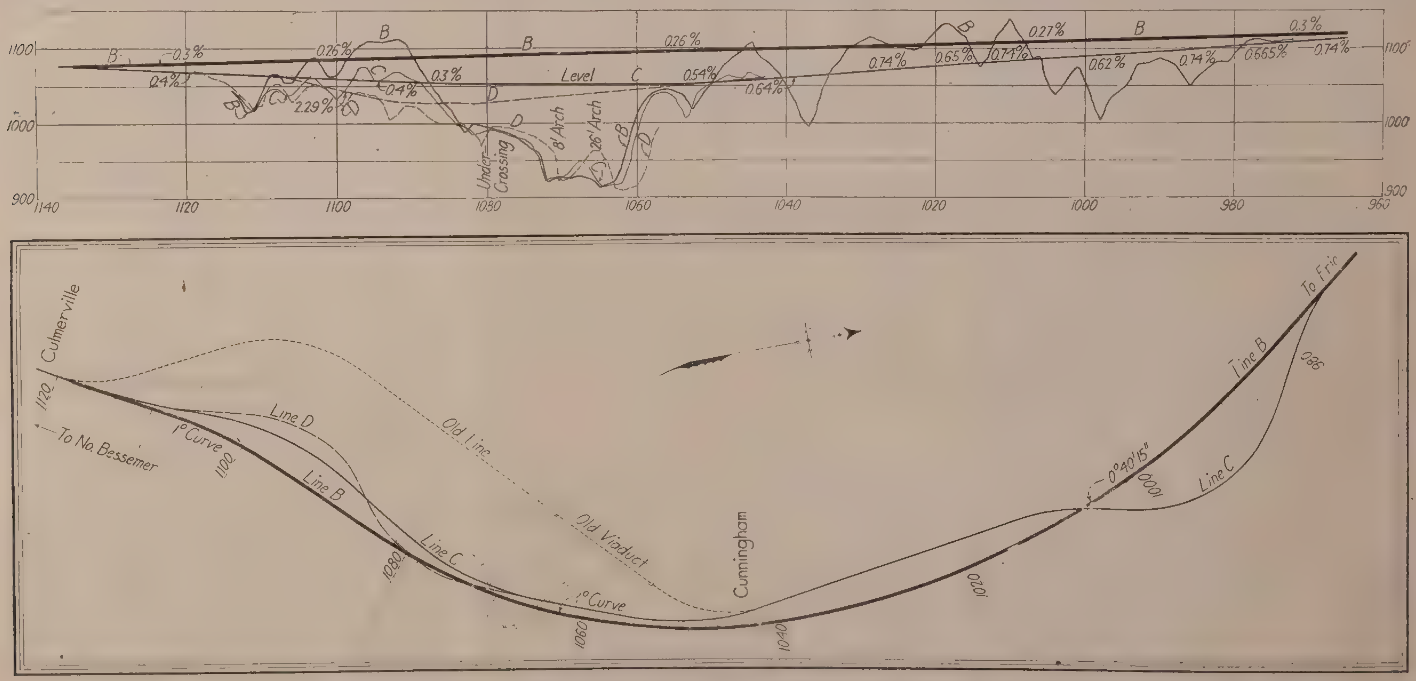
Contents of 88,000 Railroad Cars Have Already Been Consumed in 4,500,000-Yard Embankment, and Trestle for Final 50-Foot Lift Is in Place

A fill that will reach a maximum height of 185 ft. and a bottom width of 600 ft., one that has been consuming an average of two train loads of steel-mill refuse per day for the last three years (enough cars to reach more than half way from New York to Chicago) and will still require 1,000,000 cu. yd. for completion—this is the present outstanding feature of the grade-reduction program that the Bessemer & Lake Erie Railroad has been carrying out on its line for many years. The fill is located near Culmerville, Pa., about 25 miles from Pittsburgh. Sweeping around well up the sides of a range of hills on a 2-mile curve, 1 deg. in part and 40 min. in part, the new line, besides taking up a sag and replacing a large part of a 0.75 per cent grade with a 0.3 grade, breaks away from the old line, eliminating several curves and shortening the line considerably.

It also eliminates a steel viaduct 1545 ft. long and 155 ft. high, and this structure is now being removed and transplanted as a dumping trestle at the site of the Allegheny River bridge of the same railroad, where another large fill is to be made. Three trestles have been buried in the fill at Culmerville, known as the Bull Creek fill, which now rises to a maximum height of 135 ft. and carries the two main tracks. A fourth trestle alongside the main tracks and rising 50 ft. above them marks the ultimate top of the fill. Up to March 1 the contents of 88,446 cars had been placed in the embankment. Probably 25,000 more will be required. The entire fill is being made by company forces, at a cost of about 20 cents per yard.

Disposing of Steel-Mill Refuse

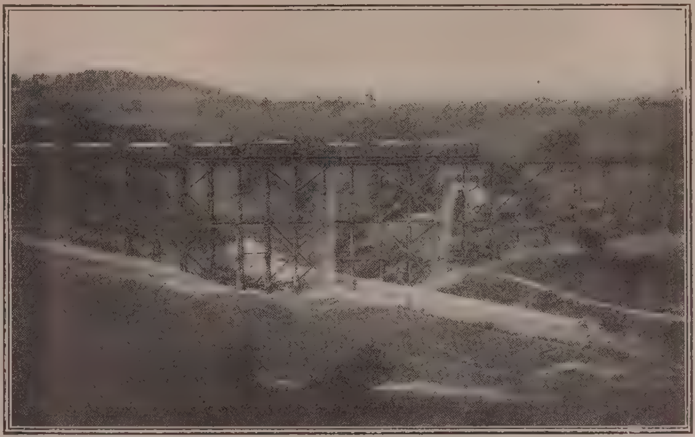
The Bessemer & Lake Erie Railroad, which is controlled by the U. S. Steel Corporation and extends from Erie and Conneaut Harbor on Lake Erie to a connection with the Union Railroad near Pittsburgh,



GRADUAL RAISING AND STRAIGHTENING OF GRADE SHOWN BY PLAN AND PROFILE OF OLD LINE AND OF NEW IN ITS VARIOUS LOCATIONS

Line *D*, temporary construction; line *C*, present location; line *B*, final location.

AN EARLY STAGE OF THE WORK—ULTIMATE FILL WILL BE 50 FEET HIGHER THAN OLD VIADUCT ON LEFT



A GOOD PART OF THE MATERIAL HAS TO BE SHOVELED FROM THE CARS—NOTE LENGTH OF 8-FOOT CULVERT

is used primarily for handling ore from Lake Erie to the Pittsburgh steel mills and for handling coal and steel in the opposite direction. As this traffic is heavy the line is double-tracked, and much money has been spent in the last fifteen years to reduce the grades and curvature. The considerations affecting grade revisions are entirely different from those of the average railroad. When the steel mills are in full operation the railroad is called upon to dispose of several train loads daily of slag and other steel-mill refuse. Consequently, when a grade reduction is contemplated the profile sought is not one that will balance cut and fill, but one in which the excavation will be minimized and the embankment held within reasonable but liberal bounds. In the Bull Creek fill the total excavation will hardly exceed 100,000 cu. yd., as compared with 4,500,000 cu. yd. of embankment.

LINES B, C AND D

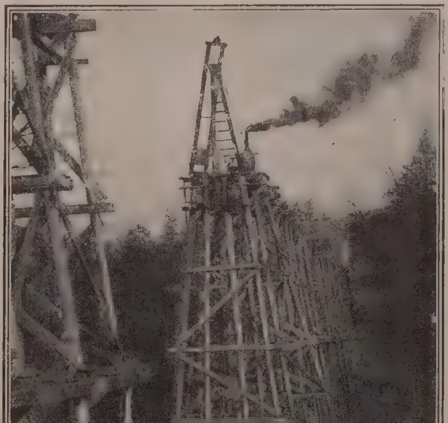
In the accompanying plan are shown three lines, *B*, *C* and *D*, together with the original line. Line *B* is the ultimate alignment. Line *C* is that followed by the main tracks at present. Line *D* is that of an earlier temporary construction location. An examination of the accompanying profile will explain these lines. The deepest part of the fill is in the vicinity of Sta. 1065. At about Sta. 1055 the ground line comes up to the present profile, although the ultimate profile will still be on a 50-ft. fill. A nose projects westward across the lines about Sta. 1095; and while the high profile rises well over the top of this, it was necessary to swing the lower lines out around it to avoid excessive excavation. Another line, line *A*, was contemplated which would have made no swing around this nose, but would have carried the Culmerville tangent north to tangency with the long curve at about Sta. 1070. This was abandoned, however, because it made the cut excessive.

The line *C*, joining the old line at Cunningham, although only a temporary line, has a better alignment and virtually the same profile as the original line. Except where it swings out at Sta. 1095 to avoid the cut, it falls entirely on the large embankment, and therefore did not require any considerable amount of extra grading. Cunningham is at the foot of a 4-mile northbound ascent on what is now the ruling grade, 0.75 per cent. By giving the new fill another lift, beginning the ascent at the tunnel just south of Culmerville and running up on a 0.3 per cent grade, compensated, the new profile finally intercepts the old nearly half way up the 4-mile ascent, and thereby greatly reduces the problem of bringing the rest of this grade down to 0.3 per cent. At the same time the new line, from Cunningham to the point of crossing with the old, is on higher ground, so that the long sweeping curve at once improves the alignment and reduces the yardage.

WORK BEGUN IN 1912

Work on this improvement was begun in September, 1912. The line *D* was built on a 3 per cent grade from the old line to the south end of the low-level trestles. This trestle had a maximum height of 70 ft. The form of construction is shown in some of the photographs. Longleaf yellow pine was used for the longer timbers and maple or native wood for the shorter lengths. When this trestle had been filled, which was about April, 1913, a second one was built on the same level parallel to and some distance from the first. This had been filled by November, 1913, and during the winter the space between trestles was filled and the tracks were jacked up about 10 ft.

In the spring of 1914 a new trestle 45 ft. high was placed on top of the first lift, on the line *C*. This trestle was all filled, and since then spreading has been done from it, and the entire embankment has been given an additional lift of some 10 ft. The main tracks have been located on the line *C* and have been in service since May 31, 1915. The embankment at this height is of ample width, so that the trestle for the final lift could be built on the line *B* without interference with regular operation on the line *C*. This last trestle is practically completed, and dumping from it has begun.



TYPICAL 70-FOOT TRESTLE — LONGER TIMBERS LONGLEAF YELLOW PINE, SHORTER ONES MAPLE OR NATIVE WOOD

The removal of the viaduct on the old line, which, as previously stated, was 1545 ft. long and 135 ft. high, has been nearly completed. This viaduct is to be re-erected 9 miles south alongside the north viaduct approach of the bridge over the Allegheny River, which is being reconstructed as a double-track bridge. (See the Engineering Record of June 3, page 744.) The viaduct in its new location will be used simply as a dumping trestle, to avoid interference with traffic on the main line. The viaduct will be completely buried in the fill.

CULVERTS 700 FEET LONG

In connection with the Bull Creek work several long culverts were necessary, two of them being under the deepest part of the fill. Bull Creek passes under the fill through a 26-ft. arch 716 ft. long, while another creek occupies an 8-ft. arch 678 ft. long. There is another 26-ft. arch 311 ft. long carrying a highway, and in connection with the grading of this highway over a deep fill it was necessary to build a 6-ft. waterway arch 174 ft. long under the highway. A conception of the length of these culverts is given by the view showing cars being unloaded from a trestle.

The progress of this work has been governed largely by the supply of material from the steel mills. The work, it has been noticed, was started more than three years ago. During this time an average of nearly 100 cars has been unloaded in the embankment each working day. Up to March 1, as previously stated, 88,446 cars, averaging probably 35 cu. yd. each, have been unloaded in the embankment. Last February 1685 cars were so unloaded. From now on, as a good profile and alignment on the new embankment have been obtained, and as other improvements, particularly that at the Allegheny River bridge, will demand a good part of the available refuse, progress will be slower.

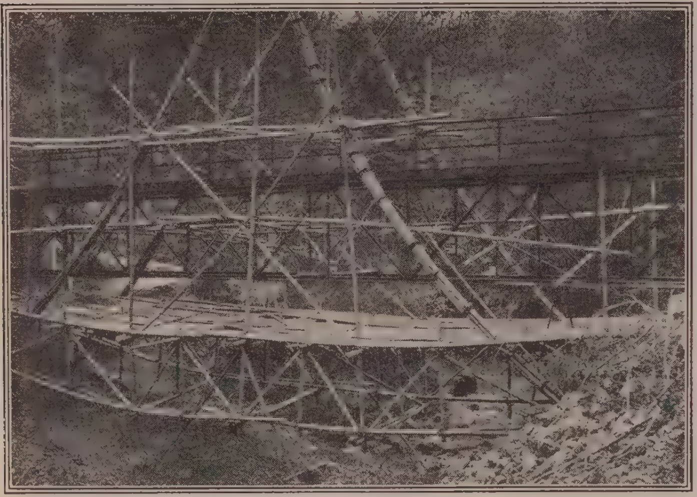
The material making up the fill takes a slope of about 1½:1, and there is little or no shrinkage. There has also been no trouble from slips, although earth and clay embankments in the vicinity have given much trouble. The upper-level trestles have held their line well.

This grading and trestle work, like most of the grade-reduction work and double-tracking carried out by the company in the last ten years, is being done entirely by company forces. Although it has been necessary to shovel a good part of the material, for the reason that the company gets the cars from the Union Railroad and has no control over the class of cars used, the entire grading work, which includes the trestles, but excludes the land and the culverts, has been done at a cost of about $6 per car, or less than 20 cents per cubic yard. The work is handled by the regular organization of the Bessemer & Lake Erie Railroad, of which H. T. Porter is chief engineer.

Falsework Lashed Together With Vines on Java Bridge

By J. W. Swaren

Vines were used to lash together the bamboo falsework for a steel frame bridge recently completed by a Chinese contractor in Java, using native labor. The material used for the falsework cost $16, and the labor of putting it in place $24. The ingenuity of the contractor in using vines, gathered from a jungle near the bridge site, to lash the falsework together was doubtless partly responsible for the low cost.



BAMBOO FALSEWORK UTILIZED IN CONSTRUCTING BRIDGE

The bridge was built in a single span of about 29 ft., with roadway about 10 ft. wide, to permit the transporting of tea machinery and Pelton water wheels into a new tea growing section.

Fewer People Use Brooklyn Bridge

More passengers use the Williamsburg Bridge in twenty-four hours than pass over any of the other three East River bridges in New York City, according to a count of the bridge department of that city. The daily travel in both directions over this bridge was 327,134. Travel over the Brooklyn Bridge, the next in importance, fell off 16 per cent from the year previous, the number crossing the bridge in 1915 being 243,617 in one day. Travel over the Manhattan Bridge more than doubled because of the opening of the Fourth Avenue subway, 111,314 persons using this bridge daily. The daily travel over the Queensboro bridge increased slightly to a total of 93,654 persons in twenty-four hours. The daily traffic increased by 47,144 passengers to 804,146 for all the bridges.

Engineers Allocate All Uses of Illinois River —Floods, Farming and Fisheries

Alvord and Burdick Define Flood Rates to Be Expected, Waterway Sufficiency and Interests Involved, and Recommend Raising Levees

Engineers have for the first time made a comprehensive study of all the complex problems of the Illinois River relating to flood control, to the effect of the extensive reclamation of farm lands within the past ten years and to the rise and decline of the fish industry. In the 140-page report of John W. Alvord and Charles B. Burdick to the Rivers and Lakes Commission answers are given to these questions: (1) What future floods may be expected? (2) Can the present waterway care for them? (3) What interests are affected by past and probable future improvements, and how? (4) What plan will correct the deficient waterway and produce the maximum benefit to the local interests and to the public? The answers given are as follows:

1. Once in fifty years there may be expected a flood 35 per cent greater than that of 1904, when the rates reached 80,000 sec.-ft. at Peoria and 125,000 sec.-ft. at the mouth of the river. These rates are equivalent respectively to 5.94 and 4.48 sec.-ft. per square mile.

2. In the lower one-third of the river farm-land levees have reduced the width of the flood plane by about 80 per cent and have reduced the cross-section of the flowing stream in a great flood to about 25 per cent of the available cross-section of the 1904 flood. Although a large part of the flood flow has always passed by way of the channel, the velocity being comparatively slow upon the land, it is concluded that the farm-land levees are a menace to themselves in that they have restricted the flood-water channel to such an extent, and are so lacking in height, generally speaking, that they are likely to be overtopped in a great flood. As the protection afforded to different districts is quite variable, it is evident that the lowest levees will suffer first and will tend to protect the higher levees. If all the districts are to be protected, however, a greater available flood cross-section must be provided, which may be accomplished in several ways, or the flood rates must be reduced through storage.

3. The predominant interests in the river valley are agriculture and fishing. There are other important interests at Peoria and at a few of the other cities bordering the stream.

Since 1904 the construction of levees for the protection of the bottom lands has proceeded at a rapid rate. The total leveed lands are estimated at 171,725 acres. These lands have been protected from floods at an estimated cost of $30 per acre. The estimated full value of these lands is $112 per acre. Projected levee districts aggregate about 49,250 acres.

It is estimated that the leveed lands produce crops to the value of $3,000,000 per annum, and that when these districts are fully cultivated they will be capable of producing $5,000,000 per annum. With the projected districts completed and fully cultivated, together with a small acreage upon the higher ground, now successfully cropped without levees, the total yield from agriculture will be $6,500,000 per year. The fish crop was worth $860,000 in 1908, but is now about one-half of that. The annual catch upon the Illinois River had gradually increased from about 6,000,000 lb. in 1894 to 12,000,000 lb. in 1900 and 24,000,000 lb. in 1908. The great increase is probably largely accounted for by the rapid increase of the German carp, which first began to appear in the catch of the Illinois River at about the date of the earliest statistics above mentioned. All fish life was undoubtedly stimulated by the increased stages of water that have prevailed since 1900. The decline since 1908 is probably due to a number of causes, including the lesser flood stages prevailing in recent years and the large number of lakes (about 17,740 acres) excluded from the river through the construction of agricultural levees, shutting off the breeding and feeding grounds of fish and the places where the larger part of the seining has been done. About 36 per cent of the original lake acreage has been inclosed since 1908.

Agriculture is the predominant interest of the valley and now furnishes and will hereafter furnish a much greater addition to the wealth of the state than is produced or can probably be produced hereafter by the fisheries. As far as possible, however, both interests should be promoted in harmony.

Reservoirs and Fish Culture

In Europe, where the flood problems and the fisheries have been studied for a longer time than in America, the suggestion has been made to promote the fisheries and reduce the floods upon the diked rivers by admitting water to certain of the leveed districts in rotation during each spring season and allowing the water to return to the stream during the low-water season. All this is done with the object of reducing the spring freshets, artificially providing overflowed land for the breeding and rearing of young fish and the periodical enrichment of the land by the sediments of the flood waters. An endeavor was made to demonstrate the practicability of such a scheme upon the Illinois River.

No great flood has occurred upon the river since the occupation of the valley by levees approaching the present scale of development, but it is estimated that if the 1904 flood should be repeated under the same conditions of water level in the Mississippi, a number of levees would be overtopped. If a flood 35 per cent greater in rate than the flood of 1904 should occur, and if such a flood should enter the Mississippi at the height of water prevailing in 1844, more than one-half of the levee districts would be flooded, and under the conditions of levee construction likely to prevail in the future nearly all the levee districts would be flooded.

The exclusion of the flood waters from the bottom lands through the construction of levees has a tendency to increase the flood run-off rates of a stream. The net effect of all the levee districts so far constructed would probably increase the maximum flow rate only about 5 per cent, and when the bottoms are fully leveed about 10 per cent. This rather unexpected result is accounted for by the fact that in an excessive flood, such as the flood of 1904, the valley is practically filled with water several days before the apex of the flood, and the maximum flood rate occurs at a time when the gage height is nearly stationary for several days before and after the apex. A smaller stream or a more flashy stream would doubtless make a better utilization of the storage in its valley.

MACHINE SPREAD SAND FOR SEAL COAT

4. In general there are three ways to increase the available prism for the passage of flood waters. The width of the flood stream may be increased by setting the levees back a greater distance from the river bank, but this remedy is impracticable on account of the cost, except where new levees are to be built. The flood-water prism might also be increased by lowering the bed of the river, as in the construction of a deep waterway. In the opinion of the engineers dredging operations undertaken especially for this purpose would be too costly as compared with other remedies, and none of the projects for improved navigation would affect the flood-water levels any sufficient amount to be of material benefit.

HIGHER LEVEES RECOMMENDED

The available cross-section for flood waters can be most economically enlarged by increasing the height of the levees. The circumstances would seem to warrant the building of levees to a height about 3 ft. above a great flood, assuming it to enter the Mississippi River at about the height of the flood of 1904. The excess height of levees is recommended to provide for wave wash and in emergency as a small factor of safety, to prevent disaster in case of a greater flood. It is believed that in the protection of these farm lands the danger from loss of life is small and, therefore, that it is not wise to provide against a flood of extremely rare occurrence or to provide a factor of safety that would be justified in the protection of a city where great loss of life might result from the unexpected.

To comply with the above recommendation the higher levees at present would be increased from 2 to 3 ft. The lowest of the levees lie about 6 ft. below what is regarded as a desirable elevation. As nearly as can be estimated from rather incomplete data, the cost of bringing all the present levees up to the desirable plane would be about $2,532,000. The total expenditure, including this item and also the total cost of all future levee districts, is estimated at about $8,154,300. If all future levee districts should be so built that they might be utilized for storage of the apex flood waters, the necessary levee heights in the upper three-quarters of the river could be reduced from 2 to 3 ft., but this would still require that nearly all of the levee should be increased in height at a total estimated cost of $1,592,000. The total expenditure, including this item and also the total cost of all future levee districts, is estimated at $5,389,000.

Giving the storage proposition the benefit of all the doubts, including the practicability of manipulating the reservoirs during the flood and the benefit accrued to the fisheries, it is estimated that the largest financial return to the community will be effected through the utilization of the bottom lands for agriculture and increasing the height of the levees such an amount as is necessary to protect the lands. The predominance of the agricultural interest does not require that the fisheries of the Illinois River should be abandoned. It is believed, notwithstanding the present and future of the levee districts, that a scientific utilization of the remaining public waters, including the river and twenty or more meandered lakes, together with the best use of the remaining undiked bottoms and the spaces between the river banks and levee toes, will result in the maintenance of a valuable fishery.

Pennsylvania Will Try Wider Freight-House Platforms

A platform 10 ft. wide instead of 8 ft. on the track side will be provided in a freight house which the Pennsylvania Railroad is about to build in the Pittsburgh district, according to G. W. Snyder, principal assistant engineer at Pittsburgh. The company has found that because with the 8-ft. platform, trucks cannot conveniently pass outside of the building, it is virtually necessary to reserve a trucking lane inside of the house. By adding 2 ft. to the width of the outside platform it is thought that this waste of space inside will be eliminated.

Bitulithic Pavement Laid Over Old Gravel Road

Construction Methods Explained and Costs Given for 5½-Mile Section Near Tacoma, Washington

By DAVID H. WHITE
County Engineer, Tacoma, Wash.

UTILIZING an old gravel road on alluvial soil as the sub-base, Pierce County, Washington, has laid a 5 1-3-mile section of bitulithic pavement on the road which begins at Alderton, about 15 miles southeast of Tacoma, and ends at Orting. The pavement has a 2-in. bitulithic top, is 16 ft. wide, contains 49,878 sq. yd. and is laid on a 5-in. 1:3:6 concrete base, with 6-in. concrete curbs. The base and curbs contain 52,979 sq. yd. The curbs are monolithic with the base; 3-ft. bank-run gravel shoulders make the total width of the roadway 23 ft.

The contract was let to the Washington Paving Company for $76,549 with a 5-yr. maintenance bond costing $500 extra, making the cost to the county $1.445 per square yard, divided as follows: Subgrade and extras, including curbs, 23.4 cents; concrete base, 60 cents; bitulithic top, 68.6 cents. The cost per mile was $14,391.61.

PAVEMENT COMPLETE BUT FOR SHOULDERS

MATERIALS AND PLANT

Sand for the bitulithic top and sand and gravel for the concrete base were obtained from a pit, owned by the contractors, 0.6 mile from McMillan, where the bitulithic plant was stationed. It was 2.2 miles from one end of the pavement and 3.2 miles from the other, making the average haul for the aggregate for concrete 1.95 miles and the average haul for bitulithic mixture 1.35 miles. Crushed granite rock for use in the bitulithic top was furnished to the contractor at cost from the county-owned quarry at Kapowsin. The contractor paid freight on the crushed rock at 1 cent per ton per mile from Kapowsin to McMillan, a distance of 13 miles. Cement cost the contractor $2.30 per barrel delivered on the work, with a rebate of 40 cents per barrel for sacks.

In the construction of this work a one-car asphalt plant was used by dividing the sand bin into four compartments. The plant consisted of a rotary drum to heat the sand and rock, oil being used for fuel. Elevators lifted material into sizing screens over the bins. Bitulithic cement was heated in three kettles by coal and staves of barrels. The weighing machine had a scale of seven beams, weighing platform, buckets and mixing boxes. The crushed rock and sand were piled separately near the end of the rotary drum and a two-horse scraper was used to bring the rock and sand to the elevators for delivery to the heating drum. It takes about 4 min. from the time the aggregate starts in the drum to reach the bin. The rock is heated to from 240 to 250 deg. Fahr. After leaving the drum the aggregate is lifted onto the screens, which separate it into four sizes, passing into the bins as follows: Bin 1, aggregate passing a No. 10 mesh; bin 2, passing ¼-in. screen and retained on No. 10; bin 3, passing ½-in. screen and retained on ¼-in.; bin 4, passing 1¼-in. screen and retained on ½-in.

The following proportions were generally used, though some little variation was made to fit different material: 315 lb. from bin 1, 90 lb. from bin 2, 140 lb. from bin 3, 440 lb. from bin 4, and 15 lb. of dust finer than 200 mesh. This makes 1000 lb. of aggregate, to which was added 88 lb. of bitulithic cement heated to a temperature of 250 deg. These materials were carefully weighed, passed into a twin pug mill and thoroughly mixed for about 1 min. and 40 sec. Then they were dumped into a wagon which stood underneath. The mixture was hauled by teams and dumped onto the street, shoveled over until it was about the thickness required, raked and spread as nearly smooth as possible. It was then thoroughly rolled with a 10-ton roller until no appreciable compression appeared.

After the rolling was finished a squeegee car spread the bitulithic cement, which was heated in kettles on the street. The top was thoroughly coated with the bitulithic cement, using approximately ¼ gal. per square yard, and then covered with hot screenings from bin 1, with a little excess sand put on by a sand-spreading machine, which applied approximately 25 lb. per square yard. The pavement was then thoroughly rolled with a 10-ton roller, which completed the process.

FORCE AND WAGES

The force required at the plant and wages paid were as follows:

1 superintendent furnished by the patentees, per month	$200.00
4 feeders, 3 using shovels and 1 a hoe, to feed the aggregate into the elevators, per day	2.50
1 foreman, per month	100.00
1 drum fireman, per day	2.50
1 boilerman, per day	2.50
1 hopperman, per day	2.50
1 mixerman, per day	2.50
1 team, per day	5.00
1 night watchman, per day	3.00

From three to thirteen teams, costing $5 per day, were used to haul the material to the pavement.

The street force was as follows:

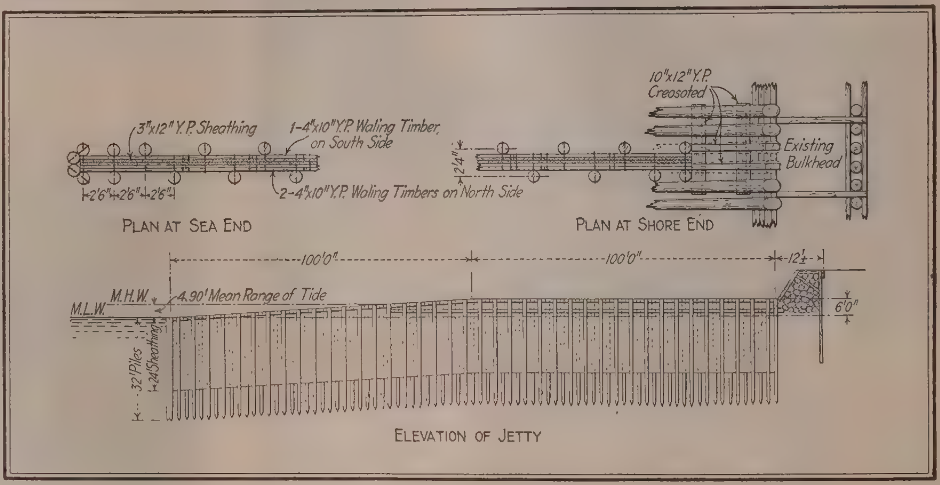
	Per Day
1 foreman	$4.00
1 rollerman	3.50
1 man cleaning pavement	2.25
1 wagon dumper	2.50
1 tamper	2.50
5 shovelers	2.50
2 rakers	2.50
2 squeegeemen	2.50

Work was begun on the bitulithic top Oct. 21, 1915, and ended Feb. 28, 1916. The total number of actual working days was 48. Work was considerably delayed on account of bad weather and breakdowns in the plant. About 2307 cu. yd. of crushed rock and 1183 cu. yd. of sand were used in the top; 953 cu. yd. of this amount of sand was taken from the river bottom and the remainder from the gravel pit. Of bitulithic cement 508 tons were used, 50 of which were for the seal coat.

Adopts Low Jetties for Shore Protection

Jersey Central Replaces Destroyed Groins at Seabright, N. J., by Longer Ones with Outer Ends at Mean Low Water

LOW JETTIES or groins, with the tops of the outer ends at mean low water, and the shore ends rising only a foot above mean high water, are being built by the Central Railroad of New Jersey along its mile and a half of trackage on the Atlantic Ocean from Highland Beach to Seabright, N. J., to replace higher and shorter jetties which have been practically destroyed by the severe winter storms of a year and two years ago. Like the old jetties, the new ones, with the exception of a stone-filled pile jetty, are of timber piles and sheathing. They are 200 ft. long, however, instead of 75 ft. They are spaced about 300 ft. apart, and the plan calls for twenty-nine new ones and extensions or repairs to three old ones. Fifteen were constructed last year before the cold weather stopped the work.



DETAILS OF LOW JERSEY CENTRAL JETTY THAT HAS PROVED EFFECTIVE

The Central Railroad of New Jersey is peculiarly exposed to the sea at this point on a coast noted for its severe storms. The Shrewsbury River, instead of finding its outlet in the ocean at Seabright, turns north and parallels the coast, emptying into the lower New York Bay at the base of Sandy Hook. This leaves a strip of beach not more than 600 ft. wide, and at points less than 300 ft., the strip culminating in Sandy Hook. The Central Railroad of New Jersey, skirting the south shore of the bay, crosses the Shrewsbury River at its mouth and swings down on this narrow strip of sand, occupying the ocean front for a distance of about 9000 ft.

JETTIES SUPPLEMENT BULKHEAD

The double-track railroad is protected primarily by a bulkhead built in 1895, and consisting of rock fill held in place by piles as indicated in one of the drawings. As a further protection, jetties had been built at intervals of approximately 300 ft. in the attempt to build up a beach and afford a permanent protection in front of the bulkhead. These jetties were 75 ft. long and rose entirely above high tide. Violent storms and high seas in December, 1913, and January, 1914 (see the news section of the Engineering Record of Jan. 10, 1914, page 13), and again in January, 1915, destroyed practically all of these jetties. The waves broke over the bulkhead and threw the tracks in some cases off the right-of-way, putting the line out of commission for the time being. While the bulkhead held and prevented any serious washout, the condition suggested the possibility of the pounding waves washing the entire strip into the river.

HIGH JETTIES FAIL TO HOLD BEACH

It has been observed that when a wave struck the high jetty it broke and dropped its burden of sand on the near side, and that this sand was likely to be washed out by the next wave, so that the jetties were not dependable as beach builders. It was believed that with the jetties built to conform as nearly as practicable to the natural contour of the beach and be low enough for the waves to carry most of their sand burden over the top, this sand would remain and build up, and would in turn protect the jetty itself. It was noted, also, that low jetties would afford much less surface for the destructive action of waves, and much less leverage. Hence it was decided to give them a trial, and, while they have not as yet been subjected to such violent wave action as destroyed the old ones, they have withstood some very high seas.

The drawings show the main dimensions and elevations of the jetties. The construction itself is ordinary, except, perhaps, that half of the piles are driven butt down. Last year fifteen of the twenty-nine were built, and it is expected that the remainder will be built next year.

QUICK WORK BY THE TEREDO

With those first built the timber of the outer 50 ft. was creosoted, but that of the inner 50 ft. was not. While there had been some evidences of the teredo in these waters, the borer had not caused any considerable amount of trouble. The uncreosoted sheathing of the new jetties, however, seemed to show a surprising vulnerability to blows from floating debris, and an examination revealed the fact that some of this sheathing had been practically honeycombed by the teredo in three months. Consequently in August, 1915, it was decided to creosote the entire 200 ft., and no further trouble has been experienced from the marine borer.

The work has been carried out under the direction of Jos. O. Osgood, chief engineer, and A. E. Owen, principal assistant engineer, of the Central Railroad of New Jersey.

Large Columns of Carbon and Alloy Steels Fail Near Yield Points of Material

Among Half-Size Models of Chords for Metropolis, Memphis and St. Louis Bridges Are Largest Columns Ever Tested—Maximum Load, 7,000,000 Pounds

By J. H. GRIFFITH and J. G. BRAGG
Pittsburgh Testing Laboratory, U. S. Bureau of Standards

TESTS made upon half-size models of the exceptionally large chord members for the Metropolis, Memphis and St. Louis bridges (some of which are larger columns than have ever before been tested), composed of high-carbon, nickel, Mayari, chrome and silicon steels, show remarkably consistent results for the ultimate strength or crippling load in relation to the yield point of the component material. The elastic limits averaged a trifle below one-half the ultimate strength. Of the eighteen columns tested, six failed by local buckling or by bending at the jaws, giving striking confirmation of the fact that care in detailing is essential in column design. In all cases the slenderness ratio was less than 45, so that these columns must be classed as short struts. No bending influence varying with l/r was observed.

The following is an abstract of the report made to the director of the U. S. Bureau of Standards covering an investigation upon the strength of large bridge columns. This investigation was conducted at the Pittsburgh Laboratory of the bureau, and the general results of the tests are published with the permission of the director.

The tests were made upon eighteen columns which were half-size models of heavy chord members in the long-span bridges under construction at St. Louis, Mo., Metropolis, Ill., and Memphis, Tenn. The specimens were constructed of nickel, Mayari, chrome, silicon and high-carbon steels, the chemical constituents of the particular steels of each member being given in Table 1.

The designs and construction of these columns conformed with the best modern bridge practice. They varied in length from 16 to 24½ ft., in cross-sectional area from 42 to 119 sq. in., and had slenderness ratios l/r varying from 15 to 44. The mechanical and structural data for the members are given in Table 2, to which Fig. 8 belongs.

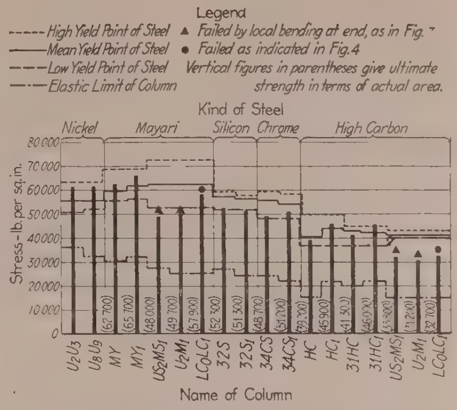


FIG. 2—RELATION BETWEEN STRENGTH OF COLUMN AND YIELD POINT OF STEEL

The purpose of the investigation was to determine the efficiency of the members as columns and the deportment of their respective details under a range of axial loads taken from an initial load of 1000 lbs. per square inch, up to the final loads at the failure of the columns.

METHODS OF EXPERIMENTATION

The columns were tested in a machine of 10,000,000 lb. capacity. Their laws of action as units were determined by an analysis of the results found from taking strain measurements with 80-in. extensometers clamped to the four corners of the specimens at their mid-points. Numerous measurements were taken also in 8 and 16-in. gage lengths on the columns, lattice bars, pin plates, diaphragms and other details. Supplementary tests were made on small specimens to obtain independent com-

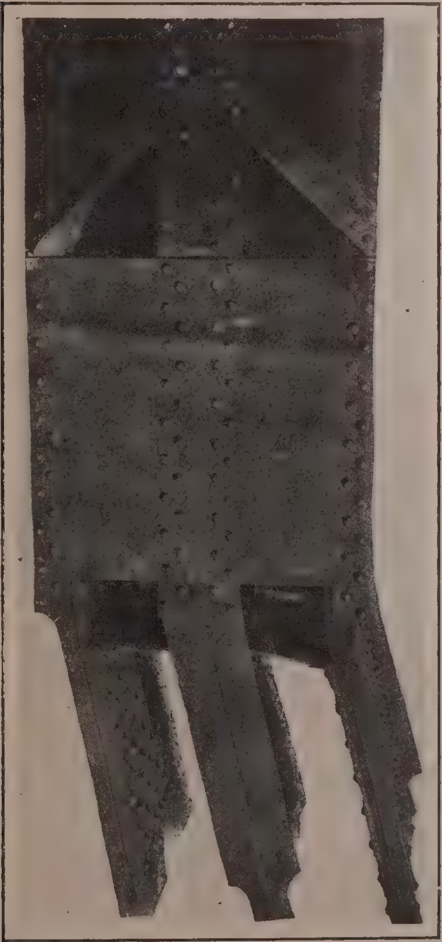


FIG. 3—TYPICAL END FAILURE (U_2M_1, MAYARI)

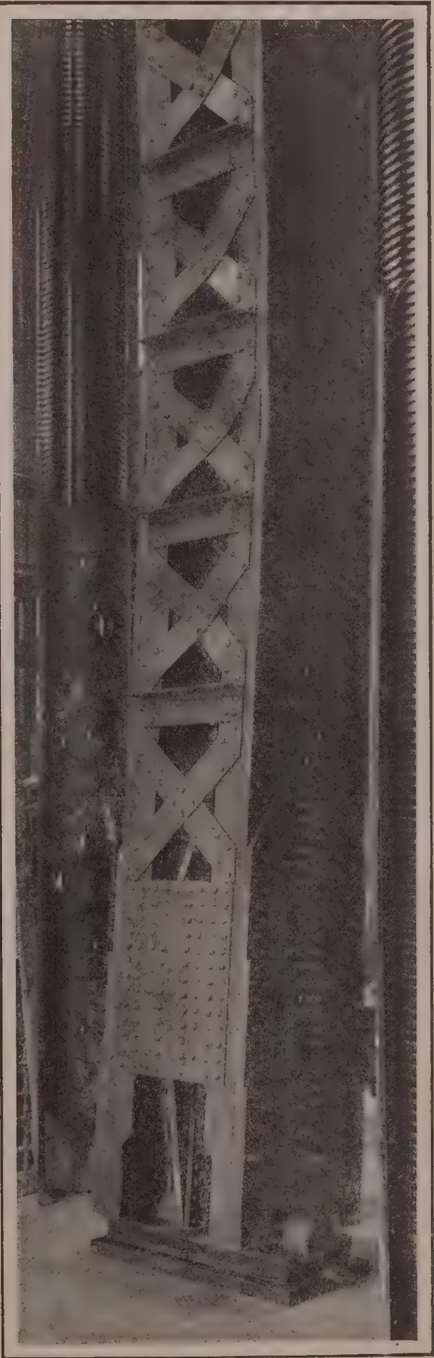


FIG. 1—NEAR CRIPPLING LOAD (31HC, CARBON)

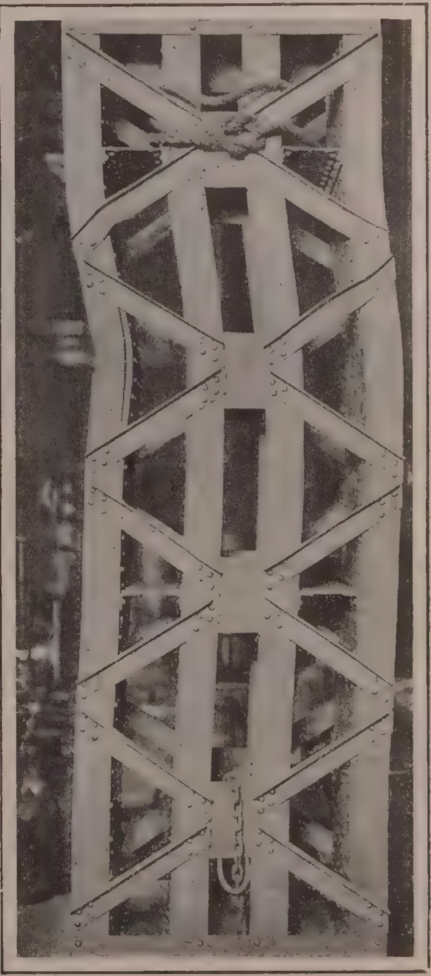


FIG. 4—LOCAL FAILURE (LC_0LC_1, CARBON)

parative data, and also for studying the effects of initial strain from fabrication. The maximum loads, elastic limits, deflections, moduli and other coefficients were found for comparative analysis. The more essential data usually desired by engineers, covering maximum loads at failure and their relations to the yield points of the component steels, are shown graphically in Fig. 8. The maximum loads given are based upon nominal areas. The exact areas were determined by weighing the specimens, and are recorded in Table 2.

RESULTS ARE CONSISTENT

It will be seen from Fig. 2 that twelve of the eighteen members failed as units. The average of the loads at failure was found to be practically identical with the mean yield point of the component steels, the mean deviation being only ½ per cent. The range of deviation from the mean yield points in absolute values for the individual specimens varied from 4 to 12 per cent. The curve for the failures is practically confined to a zone defined by the curves (Fig. 2) drawn for the high and low extremes of the yield points for the specimens.

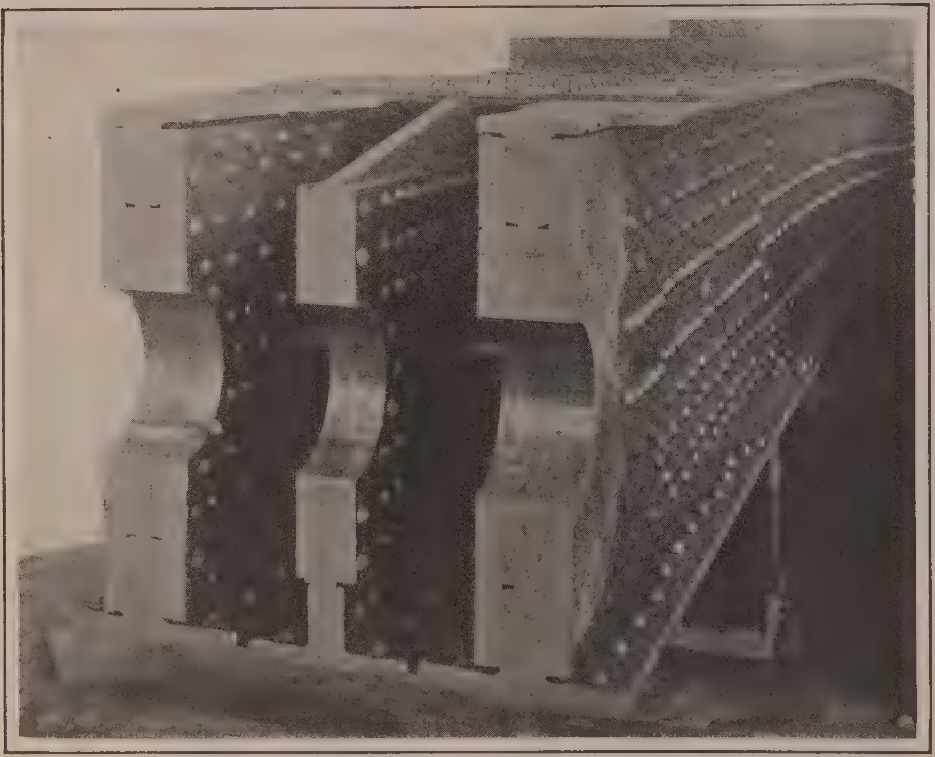


FIG. 5—CHARACTERISTIC DEFLECTION CURVE, METROPOLIS BRIDGE MODELS (34CS1, CHROME)
Transverse lattice angles prevented pantograph action of lacing.

Of the remaining six specimens, four (as indicated in Fig. 2) failed by bending locally at the ends before the full strengths of the columns were attained, owing to the fact that the forked ends required for the ingress of eyebars at the pin were too long in unsupported length to prevent flexure at the junction with the main shafts. The behavior shown in Fig. 3 is typical of this method of failure.

Two members failed in the plane of greatest theoretical strength through the ribs distorting in the body of the column, although one of these failures fell well within the zone of yield points already mentioned. The type of failure is indicated in Fig. 4. The influence of a column formula reduction factor was not discernible. When deflections first became visible they occurred in a short range of loads near the maximum loads observed and increased to 1 or 2 in. as the load progressed. No laws were found connecting the observed stresses with the deflections.

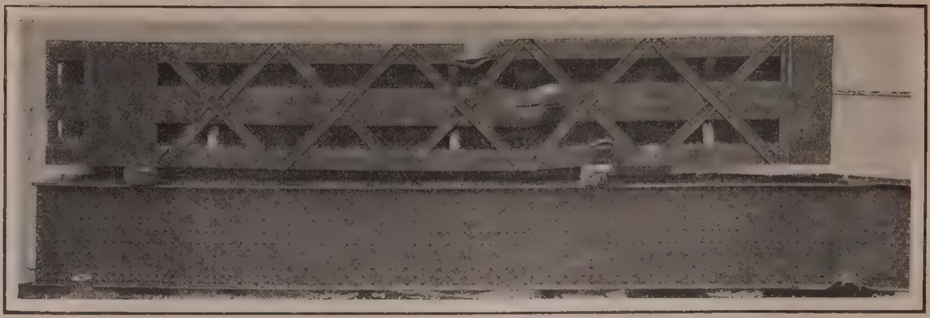


FIG. 6—ST. LOUIS BRIDGE COLUMN MODELS FAILED BY BUCKLING
Upper specimen, U_2U_3; lower specimen, U_8U_9. Photographs Figs. 1, 5 and 6, through courtesy of American Bridge Company, G. F. Sparhawk, engineer.

EFFECT OF DISTRIBUTION OF METAL

In the ten tests for the Metropolis bridge the lengths and cross-sectional areas were identical, but five of the specimens had additional flange angles turned outward and also somewhat thinner web material than the remainder (see Table 2 and Fig. 8). There were three times as many failures occurring above the respective mean yield points of the column steel of this set as there were in the case of the five columns which were thicker and more compactly built, but which had only one set of flange angles which were turned inward. It was inferred from this fact that there is an effective distance from the column axis for placing the steel, even in columns of small slenderness ratio, and that the influence of a cross-sectional form factor cannot be entirely ignored in constructing large bridge columns very compactly with respect to the metal of shafts and column details and without much reference to the radius of gyration of the section.

The average elastic limit of the columns failing as units occurred at a stress equal to about 48 per cent of the maximum load. The values given in Table 2 are conservative estimates from the stress-strain curves, as in Fig. 7. The mean modulus of elasticity for the fifteen columns was 29,600,000 ± 120,000, as found by least-square methods. The coefficient of lateral expansion of the steel was approximately that found for plain steel, the range being from 0.291 to 0.327 with a mean of 0.30.

STRESS DISTRIBUTION NOT UNIFORM

There was some apparent lack of integrity of action of the steel shapes in the members, causing variations in the uniformity of stress distribution over the column cross-sections. This was attributed to variations in the yield points and other properties of the component steels, a partial breaking down ultimately of the longitudinal frictions between shapes at a well advanced stage of loading, and the effects of internal initial strains induced by the driving of rivets. The influence of initial strain from riveting was given as a partial cause of the lowering of the elastic limit of the member, but the shortening due to "crimping" or internal buckling of the shapes as this increased with the load was also considered to be an essential factor. Supplementary tests upon independent riv-

TABLE 1—PROPERTIES OF STEEL IN COLUMNS

		CHEMICAL TESTS								PHYSICAL TESTS			
		ELEMENTS—PER CENT								YIELD POINT			Ultimate load
	Name of column	Ni	C	P	Mn	S	Si	Cr	Cu	Mean	High	Low	mean
Municipal Bridge, St. Louis	U_2 U_3	3.51	0.29	0.014	0.59	0.031	....	....	....	55,500	63,100	50,500	93,300
	U_8 U_9	3.59	0.32	0.015	0.59	0.033	....	....	....	55,200	63,100	52,040	93,060
Metropolis Bridge	HC	....	0.36	0.012	0.43	0.030	....	....	....	40,700	50,000	37,590	76,660
	HCl	....	0.36	0.012	0.40	0.030	....	....	....	44,100	50,000	37,650	75,930
	MY	1.12	0.34	0.010	0.68	0.037	0.10	0.53	0.10	59,900	68,380	55,890	100,610
	MYl	1.12	0.34	0.010	0.68	0.037	0.10	0.53	0.10	62,100	68,380	56,080	101,170
	31HC	....	0.28	0.017	0.64	0.031	....	....	....	42,900	45,440	37,280	73,400
	31HCl	....	0.28	0.017	0.64	0.031	....	....	....	42,700	45,440	37,280	74,400
	32S	....	0.35	0.017	0.83	0.039	0.38	....	....	57,200	58,840	51,940	87,700
	32Sl	....	0.35	0.017	0.83	0.039	0.38	....	....	56,500	57,480	51,940	88,300
	34CS	....	0.31	0.017	0.49	0.028	0.13	0.66	....	55,800	59,290	48,260	82,700
	34CSl	....	0.31	0.017	0.49	0.028	0.13	0.66	....	54,200	58,010	48,260	83,600
Memphis Bridge	US_2 MS_1 (Carbon)	....	0.23	0.012	0.49	0.027	....	....	....	41,740	43,700	40,250	65,420
	US_2 MS_1 (Mayari)	1.58	0.33	0.016	0.64	0.027	....	0.37	....	62,430	72,160	52,000	99,800
	U_2M_1 (Carbon)	....	0.23	0.012	0.49	0.029	....	....	....	41,740	43,700	40,250	65,420
	U_2M_1 (Mayari)	1.58	0.33	0.016	0.64	0.027	....	0.37	....	62,830	72,160	52,000	99,800
	LC_0 LC_1 (Carbon)	....	0.23	0.012	0.49	0.029	....	....	....	41,740	43,700	40,250	65,420
	LC_0 LC_1 (Mayari)	1.58	0.33	0.016	0.64	0.027	....	0.37	....	62,430	72,160	52,000	99,800

TABLE 2—DIMENSIONS OF COLUMNS AND RESULTS OF TESTS

Name of Column	Steel	Manufacturer	LENGTH* Ft.	LENGTH* In.	Size of Pin, In.	Type and Section, See Fig. 8	Lacing	Diaphragms No. and Thickness	AREA, IN SQ. IN. Nominal	AREA, IN SQ. IN. Actual	RADIUS OF GYRATION, IN. ⊥ to Pin	RADIUS OF GYRATION, IN. ∥ to Pin	SLENDERNESS RATIO l/r ⊥ to Pin	SLENDERNESS RATIO l/r ∥ to Pin	Elastic Limit Lb. per Sq. In. of Nominal Area	Ultimate Strength Lb. per Sq. In. of Nominal Area
U_2 U_3	Nickel	American Bridge Co.	15	8½	7½	A_1	2½-in. channels	3 and ¼ in.	88.8	......	7.55	8.57	25.0	33.6	36,000	61,700
U_8 U_9	Nickel		24	0	....	A_2		3 and $\frac{5}{16}$ in.	110.3	......	7.78	8.97	37.0	32.1	32,000	61,400
HC	Carbon	Pennsylvania Steel Co.	24	4		B	4x¼ in. diagonal bars and transverse angles 4x3x$\frac{5}{16}$ in.	3 and ¼ in.	76.14	74.58	6.73	8.46	43.5	34.5	15,000	38,400
MY	Mayari								76.14	74.90					30,000	61,500
31HC	Carbon	American Bridge Co.							75.99	76.94					20,000	41,700
32S	Silicon								75.99	76.94					27,000	52,800
34CS	Chrome								75.99	76.94					24,000	49,200
HC1	Carbon	Pennsylvania Steel Co.	24	4	7	C	3x¼ in. diagonal bars and transverse angles 4x3x$\frac{5}{16}$ in.	3 and ¼ in.	76.46	75.35	7.60	8.05	38.5	36.4	22,000	45,300
MY1	Mayari								76.46	75.28					32,000	64,700
31HC1	Carbon	American Bridge Co.							76.27	77.17					22,000	46,500
32S1	Silicon								76.27	77.17					24,000	51,700
34CS1	Chrome								76.27	77.17					22,000	51,800
US_2MS_1	Carbon	Pennsylvania Steel Co.	15	10	7	D	3x¼ in. bars	4 and ¼ in.	55.17	55.97	6.61	9.05	28.7	21.0	15,000	34,300†
US_2MS_1	Mayari					E	Angles 3x1¾x¼ in.	None	42.47	41.66	6.87	9.78	27.7	19.4	27,000	47,200†
U_2 M_1	Carbon		23	6	8½	F		6 and ¼ in.	96.01	95.77	7.80	9.25	36.1	30.5	15,000	31,000†
U_2 M_1	Mayari					G		5 and ¼ in.	66.55	66.02	8.17	8.47	34.5	33.8	25,000	49,400†
LC_0 LC_1	Carbon		15	6		H		4 and ¼ in.	119.00	118.18	6.74	12.14	27.6	15.3	15,000	32,400‡
LC_0 LC_1	Mayari					I		4 and ¼ in.	75.12	76.47	6.87	11.59	27.1	16.0	25,000	59,100‡

*The length is given from center of pin at lower end to square upper end, except for U_8U_9, which was tested with square bearing at both ends without using lower pin.
†Failed by local bending at ends as in Fig. 3. ‡Failed locally as in Fig. 4.

eted sections were made to illustrate the effect of initial strains from riveting on plain columns and test pieces and showed the lowering tendency on the elastic limits.

Tests of the action of details—lattice bars, diaphragms and pin plates—were made to obtain their laws of action. In the ordinary diagonal lattice used on several of the columns (see Table 2) the mechanical action was shown to approximate that of a pantograph of bars placed upon the column ribs, the maximum strains being at the transverse diaphragms and the end battens, where freedom of movement of bars was most constricted. The ten columns of the Metropolis bridge had transverse angles between panels in addition to the diagonal members, and while the amount of strain was not materially reduced, a more uniform bending of the columns was obtained, with elimination of the sharp bends in the ribs. The favorable action was also shown in the fact that each of these ten members failed with the smooth deflection curves indicated in Figs. 1 and 5, while the remaining members possessed irregular fractures of various kinds, as shown in the other photographs.

All of the pin-plate observations indicated that there was some slight movement of one pin plate over the other (typical curves are shown in Fig. 7). The opinion was expressed that the chief cause of this slipping of the pin plates was due to the intensity of the stress just over the pin, which was shown to be considerably higher than the mean, and is difficult to lower in any form of pin-connected member. The distributions of stresses in the pin plates were analyzed and their laws determined approximately. Fig. 9 shows a typical pin end of one of the Memphis bridge models.

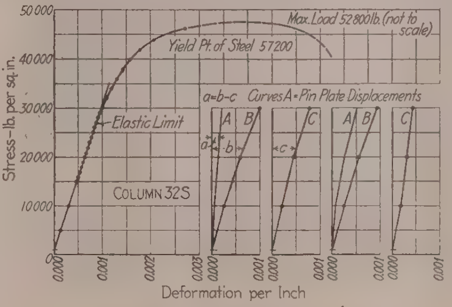


FIG. 7—TYPICAL STRESS-STRAIN CURVES

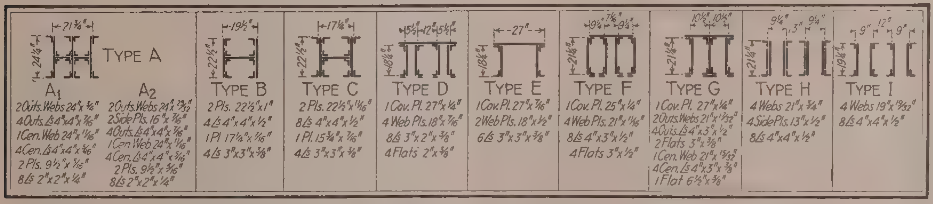


FIG. 8—TYPES AND MATERIAL IN MAIN SHAFTS OF TEST COLUMNS

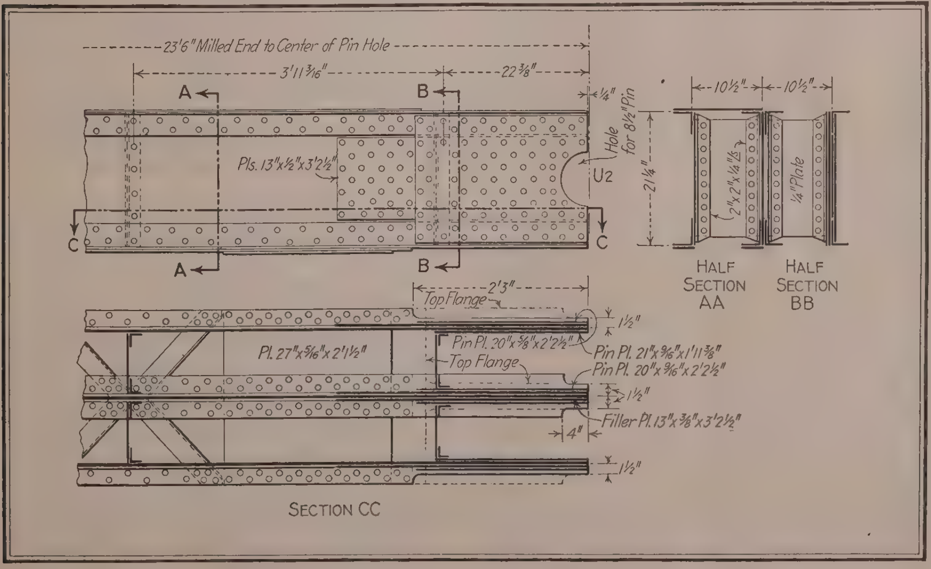


FIG. 9—DETAILS AT PIN OF COLUMN WHICH FAILED LOCALLY AT END (U_2M_1, MAYARI)

The complete data of tests and the laws deduced are contained in the larger report, but the discussion of these is too long to be included in this abstract of results.

Acknowledgments are made of the cooperation of H. C. Baird of Boller, Hodge & Baird, of New York, designers of the Municipal bridge; R. Modjeski and the late C. H. Cartlidge, of Chicago, who were the designers of the Memphis and Metropolis bridges respectively; of the various officers of the American Bridge Company and Pennsylvania Steel Company, particularly C. E. G. Larson, Thomas Earle and C. H. Mercer, and of Edward Godfrey, of the R. W. Hunt Company of Pittsburgh.

Removal of Dust Lessens Quantity of Oil Needed for Dirt Roads

When the oil is fairly free from dust a much lesser quantity of the material is required for oiling dirt roads. This fact is borne out by the experience of the Moberly (Mo.) Eight-Mile Road District, according to a letter, from which these notes are taken, from H. Frank Holman, chairman of the district to the *Highway Magazine*. Oil will serve well on any dirt that becomes hard and compact when dry. The harder and tougher the road is, the better. Consequently the importance of the road's being well graded and settled hard when the oil is applied is evident. To prepare for oil a grader is first run to remove as much dust or loose dirt as possible to the sides of the surface to be oiled, where it will serve as a dike to prevent the oil from running off. After the oiling is completed this material is graded back on to the road to absorb the surplus oil on the surface.

The road should be kept closed to traffic for at least a week after oiling, though this is seldom possible. Oiled roads will be ready for dragging from five days to a week earlier than other dirt roads after the snow has melted in the break-up season.

The district now uses 6666 2-3 gal. of oil per mile of road, from 10 to 12 ft. wide, as compared to 8000 gal. per mile in earlier work, it having been found that when the oil is fairly free from dust the smaller amount is as much as can be applied without running off, especially on parts oiled in former years. Gravity pressure wagons are used for the work. Oil is generally applied once every year.

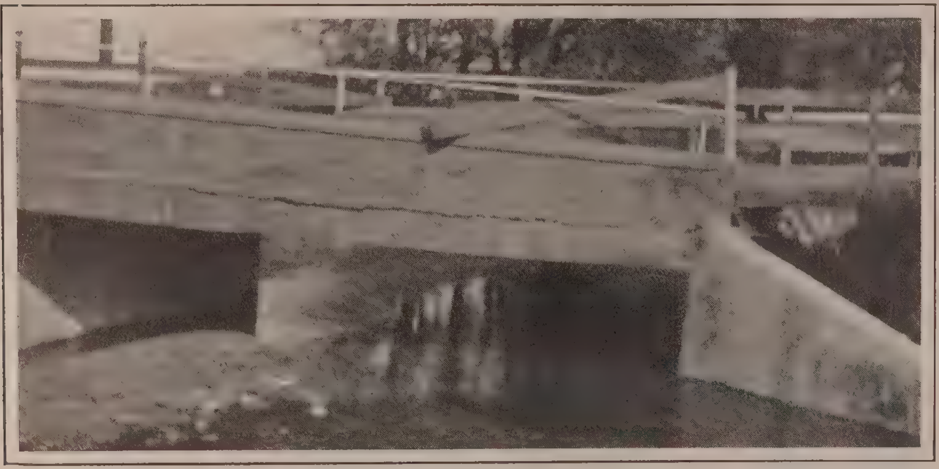
Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Reinforced-Concrete Bridge Fails at Moscow, New York

SIR: The recent disastrous flood in the valley of the Genesee River, New York, aside from the total destruction of many bridges, damaged others to an extent demanding extreme measures and careful engineering ability to restore them to grade level without impairing their efficiency.

One of these is the reinforced-concrete structure shown in the accompanying photograph—a bridge at Moscow, N. Y., of 24-ft. span, 18-ft. clear roadway and about 8 ft. high. It was constructed in 1913 and cost about $1,100. The slab is 17 in. thick with reinforcement of twisted steel rods spaced 5 in. center to center. Reinforcing rods were also used in abutments and wing walls, which are 12 in. thick set on a concrete mat 3 ft. wide and 12 in. thick.



LOWER END OF SOUTH ABUTMENT SETTLED ALMOST 3 FEET BELOW NORMAL

Failure was due to the undermining of the south abutment, the creek bed being more than 3 ft. lower after the water receded. The slab and abutments are absolutely intact, but a longitudinal crack runs the entire length of both parapet walls just at the top of slab, and also across the top of the wing walls. The lowest end is almost 3 ft. below normal floor level.

If deemed feasible, it is proposed to raise the structure to its proper position and construct a new concrete footing.

GEORGE E. SCHAEFER,
Superintendent of Highways, Livingston County, New York.
Geneseo, N. Y.

Latin-American Opportunities

SIR: In regard to opportunities for engineers in Latin America generally, the question is as broad as the profession. There are or will be many opportunities here, for the simple reason that the countries are less developed, all the engineering work is to be done and some one will have to do it. But as to whether they are "good" opportunities, the answer depends on the man. Salaries are a little higher than at home, though far from the gilded recompenses which most youngsters think them, and, on an average, I should say the work is harder and the working hours are longer by a very large proportion. Discomfort and loneliness to a degree undreamed of at home are the rule rather than the exception. If the work is near a large city where conditions are less depressing, the salaries promptly approximate those at home. At present it is true that positions of comparative importance and responsibility are attained at an age which would mean a very minor job in the States, but it takes an exceptional man to do the work. This condition is due more to a shortage of competent men than to anything else.

In general, for the very reason that there is so much to be done in Latin America, "jobs" will every day be more numerous; there *are* exceptional opportunities for the exceptional man, but he must be even more exceptional than at home to win one of them. It is no place for the mediocre man, for the increased pay (since there will be no more probability of advancement than at home) will by no means offset the increased discomfort; and lastly, the man who comes must realize that every dollar of salary he will receive will cost him, in hours of work, in personal discomfort, in nervous and physical wear and tear, and, above all, in being out of touch with former friends and with conditions at home, quite as much as, and probably a good bit more than, the same dollar would have cost him at home.

Why, then, do we stay—those of us who *do* stay—year after year? Some of us because, having arrived before we found out what it meant, and stayed while we were finding out, have learned to our sorrow that the very qualities which make us worth our salt here are distinct hindrances to our work at home, because we have got so out of touch with men and work there that getting a job is a pretty serious proposition; and because, on account of all this, we *can* make a pretty good living here and would find it hard to do so at home. Some of us stay because we are, or think we are, the exceptional man to whom I have referred, and because we have, or hope to have, one of the exceptional places. Some of us stay because we belong to "the brotherhood of the itching foot" and prefer the more rapid change and uncertainty of Latin America to the well-ordered routine of more civilized countries. Many of us—the majority, I think, if we would admit it—stay because we enjoy the very definite and comparatively satisfactory positions we occupy here in the scheme of things—the sense of being distinctly *somebody* in the local cosmos—in a word, the preference for being a fairly large fish even in a small puddle to being one of the small ones in the ocean at home.

Please pardon my discursiveness. It is a matter on which I feel strongly, both because I personally *do* like Latin America, on the whole, and because I have seen so many young men come down with large hopes, entirely mistaken ideas of the life and the work, and then make failures which might have been avoided if they had had a better idea of what they were coming to.

L. M. HUNTINGTON,
Vice-President and General Manager Bramon Estates Company.
Rubio, Venezuela.

SIR: In Porto Rico the possibilities for American engineers are small, as the island is small and very thickly populated, and has been developed for a good many years. I have spent more than half of the last 27 years in Latin-American countries, and I suppose from time to time there are excellent possibilities for American engineers in Cuba and in Central American countries. I also believe that during the next generation there will be extremely good opportunities for American engineers in the various countries of South America. American engineers, however, need patience in getting into foreign countries, as it is necessary that they learn the language and customs of the people before they can become valuable.

C. L. CARPENTER,
Manager Central Aguirre Company.
Central Aguirre, Porto Rico.

SIR: We believe that there are opportunities for American engineers in all the sugar-producing countries. We are employing at the present time five civil engineers on the extension of our railroads and other work on this plantation alone, and we know from experience that other companies require civil-engineering assistants for the extension of their plants.

We think that there are very good opportunities for mechanical engineers, as the sugar factories usually pay quite high salaries for such engineers on account of the complicated machinery in use.

VAN ALEN HARRIS,
Manager Central Romana.
La Romana, Dominican Republic.

Data and Samples of Borings in New York City

SIR: During the last few years extensive underground investigations have been carried out in New York City to determine the character of the underlying rocks and the depth and nature of the earth cover. It is estimated that about $3,000,000 has been spent for investigations of this nature by the municipality, the railroad companies and other corporations in connection with subway, bridge, dock and aqueduct construction, foundations for buildings and similar work. Probably the most extensive work of this kind has been conducted by the Board of Water Supply in determining the location of the city tunnel of the Catskill aqueduct and by the Rapid Transit Railroad and Public Service Commissions in connection with subway construction.

On Feb. 21, 1911, Dr. Charles P. Berkey, professor of geology of Columbia University, and John R. Healy delivered a joint paper before the Municipal Engineers of the City of New York on "The Geology of New York City and Its Relation to Engineering Problems." In the discussion which followed the presentation of this paper it was suggested that the society could perform a valuable service to the city by aiding in the collection and permanent preservation of all boring samples, properly labeled and cataloged. Acting on this suggestion, application was made to the Board of Estimate and Apportionment in 1913 by Alfred D. Flinn, president of the society, for an appropriation for the purpose of collecting, classifying and permanently preserving boring samples and records, and for the preparation of geological maps of the city of New York. An appropriation of $5,000 was granted with the understanding that the work should be performed under the direction of Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment. Dr. Berkey, who has acted as consulting geologist of the Board of Water Supply, was selected to supervise the work, and, aided by a corps of assistants, rapid progress is being made in collecting and classifying all available data.

Space has been assigned to the chief engineer of the Board of Estimate and Apportionment on the thirty-fourth floor of the Municipal Building. It is expected that this space will be available for use during the current year. Suitable cases for the proper storage of the borings are to be provided and an accurate system of indexing and recording them is being designed.

On April 26, 1916, James F. Sanborn, division engineer of the Board of Water Supply, read a paper before the Municipal Engineers Society on the "Preservation of Boring Records and Underground Data," which was published in the April issue of the society's *Journal*. This paper reviews briefly the geology of the city of New York and the purpose and various methods of making borings, and emphasizes the necessity of collecting and preserving these records in order that they may be made available for general use.

The municipal engineers' committee on the preservation of core borings, of which Mr. Sanborn is chairman, is assisting in the collection of all information that can be obtained on this subject.

Not only the records of borings, but also observations of earth and rock exposed in excavations, such as pits, cellars, tunnels and subways, are to be collected and made available for reference. In order to facilitate the collection of such data a set of rules and suggestions with reference to the proper methods to use in planning underground surveys are being formulated. A standard form whereby all such data can be systematically recorded has been prepared and will be made available for general use. As this work progresses and more and more data become available through additions to the collection, the city will in a few years be in possession of information which will be invaluable and to which any engineer, architect or contractor will be glad to turn.

The municipal engineers' committee and the city officials are desirous of enlisting the co-operation of all engineers, contractors and others whose work brings them in contact with subsurface conditions throughout the city, to the end that all data now available, as well as all additional information on this subject, may be collected by the city authorities and preserved for the general use of the public.

Additional data for this collection may be forwarded to Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment, or to James F. Sanborn, division engineer, Board of Water Supply, either of whom will be glad to supply further information on the subject.

VERNON S. MOON,
Assistant Engineer, Bureau of Public Improvements, Board of Estimate and Apportionment.
New York City.

Investments for Engineers

SIR: We have been very much interested in reading your editorial comments on the letter from John Berg published in your issue of May 27, 1916. It is a surprising and yet astonishing fact that most professional men are singularly unfortunate when it comes to the investment of money. As you are perhaps aware, the latter function is purely a banker's business, and none but an investment banker is qualified to give dependable advice on such a tremendously vital question.

This fact has been long recognized in England, for example, and you will find that there are very few standard publications, even of a technical character, in that country which do not have departments treating with finance.

We believe that the Engineering Record would be justified in giving further attention to this vital point.

BOWMAN, COST & COMPANY,
St. Louis. Investment Bankers.

Trailers with Motor Trucks

SIR: The article in your issue of March 25, page 420, on "Trailers with Motor Trucks" might have passed by me with little comment but for your editorial on the subject. In your closing sentences you state that "The Engineering Record believes that this analysis has shown again what ought to be obvious to all who have stopped to think about the matter and compare highway transportation with rail transportation, that the trailer is a natural complement to the truck." To those who have studied the matter it is not in the least bit obvious, and the seemingly scientific analysis made by Mr. Pennington [G. R. Pennington of the Troy Wagon Works Company, whose investigations were the basis of the article in question] is to them as full of loose generalities as an uninformed salesman.

Mr. Pennington shows only that it is feasible to use trailers with motor trucks. He distinctly does not show it is economical. The title of his article is, therefore, wrong, and the article itself is so cleverly worded on this point that even you, sir, were misled. It does not follow that because a project is feasible it is also economical.

Mr. Pennington need not have wasted time making an investigation into road resistances of various surfaces. These are a matter of common knowledge among transportation engineers and are embodied, for example, in the Society of Automobile Engineers' Handbook. Some engineers have gone much farther and accumulated considerable data on the effect of wind resistance at low speeds on heavy road vehicles—for instance, Mr. Williamson's paper before the Institution of Automobile Engineers, England, this February.

His diagrams are not at all new, and have been known for perhaps ten years. The *Commercial Vehicle* of England published six or seven years ago a large wall diagram, giving not only the tractive effort, but also surplus effort on grades and against road resistances. Similar diagrams have been published in this country many times.

All these facts and the feasibility of hauling trailers with trucks have been known to transportation and motor-truck engineers for years. Why, then, are trailers not adopted more generally, and why do large contractors, who have tried them, look askance at them? Why are the trailer manufacturers separate from the truck manufacturers? Many automobile manufacturers make motor trucks, but I do not know of any truck manufacturer making trailers, though it would be the simplest thing in the world for him to do, as a four-wheel trailer is practically made up of two-truck front axles and a body.

There must be something behind all this, and there is.

England has magnificent roads and has been familiar with road transportation by tractor (steam) for twenty or thirty years. Trailers were, and are, more in evidence along her roads than they are here, but they are always behind specially designed tractors. England, the home of road transportation, has not adopted the trailer behind the motor truck, not even in this war, where she is transporting thousands of tons for great mileages, and where the conditions would seem ideal.

France, before the war, was coquetting with tractor-trailer trains, but the war sees her using thousands of motor trucks *in puris naturalibus*. A few hundred four-wheel trailers were bought over here for use with motor trucks, but these were found unsatisfactory, though I understand some trials are being made of special two-wheel trailers under better circumstances.

Germany developed a special type of military tractor, but for ordinary road purposes her motor trucks ran alone.

Our United States has known the motor truck in its present state of efficiency for some five years. During this time the trailer proposition has been constantly in evidence; indeed, every little while some new tractor makes its bow, but only in a comparatively few cases have they justified themselves.

One of the reasons why is "obvious to those who stop to think" from Mr. Pennington's table of road resistances. It takes five times the tractive effort to propel a truck on the level on poor macadam that it does on good asphalt. That is where some of the surplus power goes to, and who knows a city or road network that does not share the bad with the good, not to speak of grades?

No, sir, the problem is not comparable with railroad haulage, nor canal haulage, where level (or very nearly so) conditions hold and resistances never vary. It is a problem all in itself, where speed, flexibility of operation, ease of manipulation, rapidity of acceleration and deceleration, and "maneuverability" are some of the factors.

A large contractor in Pittsburgh found trailers paid him slightly during the day, but caused him to lose heavily at night. His routes and roads were the same, but in the daytime the congested streets brought his average speed away down to 3 or 4 miles per hour. At night the open clear streets allowed him to run as fast as his truck would, the trailer was a hindrance to the speed, and he found very quickly an economical hindrance as well. Given wider, less congested thoroughfares and he never would have used the trailers.

The trailer, such as Mr. Pennington describes, is designed to absorb the surplus power the truck designer provides for the heavy road and the heavy grade. In brief, it is designed to absorb the factor of safety, and this is poor engineering, as we all know. There is a legitimate field for trailers, and that is as a complement to the specially designed tractor, not for the motor truck designed primarily and finally to carry a self-contained load.

JOHN YOUNGER,
Chief Engineer Truck Department, Pierce-Arrow Motor Car Company.
Buffalo.

[The foregoing letter was submitted to Mr. Pennington, who replied as follows.—EDITOR.]

SIR: The invitation you so kindly extend to me to answer in your columns Mr. Younger's letter on the trailer question, I gladly accept.

I want to get on record with Mr. Younger as being emphatically opposed to the indiscriminate usage of trailers with motor trucks. The company with whose product I am identified has been so careful and conservative in its trailer promotion that I feel sure Mr. Younger would heartily approve—but he doesn't take the time to investigate what we really claim and do prove.

For us to say that a trailer should be used with every motor truck would be ridiculous. But for Mr. Younger to say that a trailer can never be economically used with an ordinary motor truck would make him equally blind to demonstrated facts. Hundreds and hundreds of concerns didn't think a motor truck would pay under any conditions. They were finally forced to change their opinion by seeing and observing what was actually being accomplished by motor trucks at work. Theory would never convince them, but performance does.

This is not the place for a sales or advertising talk, but the same condition applies to motor-truck trailers. Many, many present users of trailers were just as strongly opposed to them as Mr. Younger could be. But demonstration in their service with a specially designed trailer led to the purchase of one. And the continuous economy of these initial installations has brought re-orders as well as new orders from others who have watched and learned, until the motor truck trailer has become an established factor in the motor-truck transportation field.

Thirty-nine different makes of trucks are operating successfully with trailers. When the modern, specially designed motor-truck trailer was put on the market, none of the truck engineers knew what their trucks could economically do with trailers. So a great many of them opposed it as rabidly as Mr. Younger now does. But that condition has changed and Mr. Younger is pretty nearly alone in saying that the trailer is never an economical proposition. The rest of the industry agrees that it is economical *under proper conditions*. That is all we want said, because we know that with that proviso there is still a tremendous field for real motor-truck trailers.

Taking up Mr. Younger's objections, point by point, he says that my article proves the feasibility of using trailers but does not prove their economy. I have at hand plenty of concrete instances proving the economy of trailers, but as these all relate to a particular make of trailer I do not feel at liberty to get specific in the editorial columns of Engineering Record.

Mr. Younger next states that the tables and charts appearing in the article were not new. Possibly not, but as far as the writer knew, however, no similar matter had been published before except such data as the S. A. E. road-resistance tables. But, whether new or not, the one thing we are interested in knowing is that these tables and charts are correct and may be relied on. The S. A. E. tables were, it is reported, obtained from tests made with steel-tired vehicles. The writer therefore made further tests to obtain the correct figures for rubber-tired trailers.

Mr. Younger asks why the truck manufacturers are not building trailers. If he will explain why these same truck manufacturers do not even build the frames, radiators, tires, worm gears and the other parts of their own machines, I may find the answer.

Again, he is very much mistaken in thinking that a real motor-truck trailer is so simple a manufacturing proposition. Possibly the reason he is so skeptical about trailer usage is because he has confined his investigations to makeshift trailers.

As Mr. Younger states, four-wheeled trailers are being used abroad in war service in spite of the fact that in such service economy is no consideration. There, where a truck may at any time be compelled to make a detour through the fields and where conditions are, therefore, the least favorable to the use of trailers, it is significant that hundreds of trailers are, nevertheless, used.

Mr. Younger mentions an instance in Pittsburgh where a contractor found trailers paid him "slightly" during the day but caused him to lose heavily during the night. I can do better than Mr. Younger; I can mention cases where trailers will not pay at all, and I can mention many other cases where motor trucks will not pay at all. As long, however, as there are plenty of places where trucks will pay and plenty of places where trailers will pay, we need not worry about the unfavorable cases.

But let us consider this particularly unfavorable trailer installation of the Pittsburgh contractor. How "slightly" the trailer paid may be judged from the fact that Mr. Younger's firm used a full page at one time to make public the economy of this very installation. As for the trailers causing a loss at night, that would be impossible, for at the very worst the contractor would simply not use them at night, allowing them to pay for themselves during the day. It is not necessary that a trailer should be kept constantly in use in order to pay for itself. Unlike the truck alone, the trailer will prosper on a half day's work.

That the trailers did not make this particular contractor any money during the night we must, of course, accept as a fact. Mr. Younger says the trailers held down the truck speed too much. Now we know from experience that 5-ton trucks of other makes will readily handle their own load and an equally loaded trailer over city streets at 9 or 10 miles an hour without undue effort, and we do not question that the trucks manufactured by Mr. Younger's firm would do at least as well. If this contractor, therefore, chose to operate at greater speeds than these his apparently increased economy must have been largely eaten up by increased depreciation, for high speed will knock a truck to pieces, while pulling a trailer will not.

Mr. Younger winds up by saying that it is poor engineering to absorb the factor of safety built into a truck. Unquestionably this is true. But it is likewise true that every piece of machinery operates most economically at or near the capacity for which it is designed. High-grade trucks such as Mr. Younger designs are built with ample power to take them up the steepest grades and over the worst roads ordinarily encountered. A truck, therefore, which is used only over improved roads, with moderate grades, is utilizing but a part of its power. The unused surplus, unless also utilized, represents waste.

The trailer is intended to be used with a motor truck when the conditions of road and grade are favorable, not otherwise. The trailer is to be used in those cases where the surplus power of the truck would not otherwise be utilized. As it takes five times the tractive force to propel a truck on poor macadam that it does on good asphalt, and ten times the same tractive force in the case of a sandy road, it is evident that a truck designed to operate satisfactorily on the sandy road will have an immense excess of tractive capacity when used only on asphalt, and will still have an excess when used even on poor macadam. To utilize in part this excess tractive capacity means increased efficiency. To do so by putting a larger load on the truck is to absorb the factor of safety of that truck. To put this extra load on a trailer behind, however, which will carry its own load, is an entirely different matter, and does not involve excessive strains on the truck.

G. R. PENNINGTON & COMPANY,
Troy, Ohio. By G. R. Pennington.

How Can Brick Aqueduct Best Be Cleaned?

SIR: We are seeking information concerning some system for cleaning the inside of a brick water-supply conduit about 5 ft. 6 in. by 6 ft. in cross-section and 4½ miles long. The substance to be removed consists of silt mixed with slimy vegetable matter, which is easly removed by a brush.

If possible, we would like to obtain some apparatus whereby a set of revolving brushes mounted on a small self-propelled car can be run through the conduit, and thus do away with the use of the large crew of men necessary for hand cleaning. If you know of any place where such a scheme has been applied we would appreciate it if you would either let us know the name and address of the organization or refer this inquiry to them.

ROSCOE L. SMITH,
Principal Assistant Engineer, Bureau of Water.
St. Paul, Minn.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

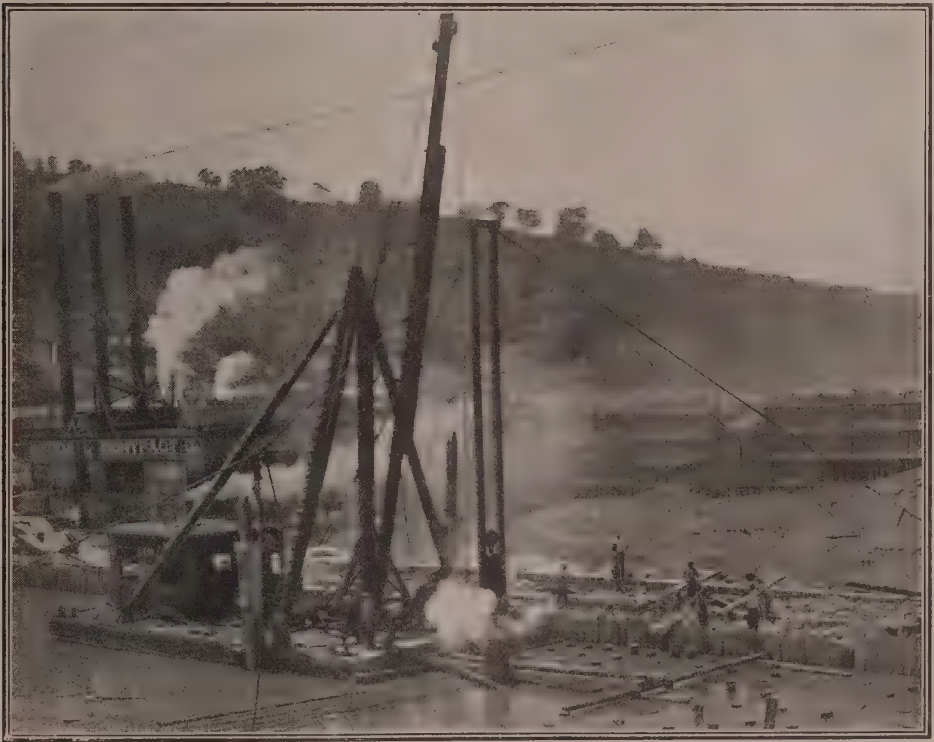
[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Swinging Leads on Derrick Boat Rigged for Rapid Driving

By GEORGE W. McALPIN

Junior Engineer, Ohio River Dam 35, New Richmond, Ohio

AS MANY as 52 piles with an average penetration of 18 ft. have been driven by the rig shown in the photograph, the feature of which is the runway sliding on a capped row of piles previously driven and on a timber suspended in front of the derrick boat, on which the swinging leads stood during driving, secured from slipping by steel points at the lower ends of the leads.



FIFTY-TWO PILES WERE DRIVEN IN 8 HOURS WITH SWINGING LEADS RIGGED ON RUNWAY

This rig was used in driving the foundation for the navigable pass at dam 35 on the Ohio River, the concrete section of which is protected on the downstream side by a long line of timber cribs filled with stone and on the upstream side by a row of sheet piling. The cribs were sunk first, the excavation for them naturally taking in enough dirt from the site of the pile and concrete section of the foundation to allow floating a derrick boat along the upstream side of the cribs after the cofferdam had been closed and pumped down below the cut-off elevation of the piles.

The concrete foundation for the pass is 35 ft. wide. The swinging leads were 44 ft. long, and a Vulcan No. 2 steam hammer operated at a speed of 70 blows to the minute was used in them. A row of piling was placed directly across the foundation, starting from the crib. A 6 x 8-in. cap, 30 ft. long, was then placed across the top of these piles and drifted to two of them. As the piles could be driven accurately to grade, the cap rested evenly on all. A 10 x 12-in. timber, 32 ft. long, was suspended from the timber heads on the forward deck of the derrick boat, over the front of the boat. The top of this timber was at the same elevation as the cap. The 30-ft. runway was made of two 10 x 12-in. timbers held 15 in. apart by cleats. The leads, swung from the end of the boom, were set on the runway over the place for the first pile and steadied by three guys, each tightened by a set of falls. The piling was brought alongside the boat rafted, one man attending to this and seeing that piles were always ready when needed. While one was being driven the pile line was made fast to another so that no time would be lost. As each pile was driven the leads were lifted just enough to clear and quickly set in position for a new pile. When a row the length of the runways had been finished, the runways were slid sidewise on the cap and the timber in front of the derrick boat slid to position for the next row. This was continued until seven rows of piling across the foundation had been driven, when it was necessary to move the derrick boat back again. Thirty-five piles could be driven in this way from one position of the derrick boat.

Each driving crew consisted of a foreman and five men. The foreman and one man set the piles and leads, one man brought piling as needed and the other three men attended to the guys, steam line and hammer. An engineer and fireman operated the derrick boat, which supplied steam for the hammer as well as water pressure for a jet. The 2-in. jet, however, was not used much in driving, but was handy when it became necessary to pull a damaged pile or work a pile back into line. A lighting plant was installed on the derrick boat, and three shifts were worked.

The piling had an average penetration of 26 ft., and an average of 24 were driven to each 8-hour shift. The work is being done for the United States Government by the National Contract Company. L. H. Prell, assistant engineer, is in charge for the government.

Tension in Cableway Easily Found

THE PROPER size of track rope for a given cableway is that which will have a factor of safety of four when the maximum load to be handled produces a deflection at the center equal to one-twentieth the span, according to engineers of the manufacturers of Hercules wire rope. The deflection is measured below a straight line between the points where the track cable passes over the towers. One anchorage should be arranged with a set of falls, so that the track cable can be let out or taken up with seasonal temperature variations to maintain this deflection and tension.

An approximate rule, which gives close results for loads in the center with the deflection equal to one-twentieth of the span, gives the tension in the track rope as five times the load plus two and one-half times the weight of the suspended rope.

Accounting for the Contractor: The Balance Sheet

By BENJAMIN L. LATHROP

Of Lathrop, Shea & Henwood Co., Scranton, Pa.

NOTHING SERVES so quickly to show the changing conditions in an enterprise as a monthly balance sheet. From it may be seen at a glance, provided the books are properly kept and the balance sheet compiled with due regard to a proper classification of accounts, just what the firm has, what is due it, what it owes, and whether a healthy improvement is taking place from month to month in the ratio of its assets to its liabilities.

The first step is to make a trial balance. Assuming that the books have been kept somewhat as outlined in the preceding articles of this series, the trial balance would have the form shown herewith. The convenient alphabetical arrangement is facilitated by the use of a loose-leaf or card ledger. After a correct trial balance has been taken, a balance sheet in the form illustrated, which shows the exact condition of the business, is easily prepared.

HOW TO TRACE TWO KINDS OF ERRORS

If the totals of the two columns on the trial balance sheet agree it is fair to assume that the ledger is correct. Suppose, how-

Arnold Brown & Co., Trial Balance, Mar. 1, 1916

	Dr.	Cr.
Anderson & Co.	150.50	
Barrett & Carter	200.00	
Arnold Brown (investment)		5000.00
Bridge No. 4		150.00
" " " Reserve	121.00	
Calvin & Co.		109.50
Cash (in bank)	8400.50	
" (petty)	7.50	
Corfu		4019.20
" Reserve	340.14	
Davis Mfg. Co.	141.50	
Chas. Dunn (investment)		1000.00
Edward Francis "		1000.00
E. F. Fraser		8.00
G. H. Ingersoll		20.00
Jones, Kipp & Lane		14.05
Leeds		2051.00
Leeds Reserve	201.66	
North Hill Arch	410.20	
" " " Reserve	150.00	
Plant	8000.00	
Reserve for Depreciation		800.00
R. Sanders, Agent	25.00	
Surplus		4566.00
State Road	560.00	
" " Reserve	250.20	
Unclaimed Wages		250.45
Thos. White, Agent	30.00	
	18988.20	18988.20

Arnold Brown & Co., Balance Sheet, Mar. 1, 1916

Resources		
Cash:		
In bank	$8400.50	
Petty cash	7.50	$8408.00
Reserves (Retained percentages):		
Bridge No. 4	121.00	
Corfu	340.14	
Leeds	201.66	
North Hill Arch	150.00	
State Road	250.20	1063.00
Plant (Equipment)		8000.00
Accounts Receivable:		
Anderson & Co.	150.50	
Barrett & Carter	200.00	
Davis Mfg. Co.	141.50	492.00
Agents' Balances:		
R. Sanders	25.00	
Thomas White	30.00	55.00
		18018.00

Liabilities			
Investment:			
Arnold Brown		$5000.00	
Chas. Dunn (Spcl. partner)		1000.00	
Edwd. Francis " "		1000.00	$7000.00
Reserve for Depreciation			800.00
Unclaimed Wages			250.45
Accounts Payable:			
Calvin & Co.		109.50	
E. F. Fraser		8.00	
G. H. Ingersoll		20.00	
Jones, Kipp & Lane		14.05	151.55
Loss & Gain			
	Loss	Gain	
Leeds		2051.00	
Corfu		4019.20	
Bridge No. 4		150.00	
North Hill Arch	410.20		
State Road	560.00		
	970.20	6220.20	
		970.20	
Undivided profits. net.			5250.00
Surplus (from 1915)			4566.00
			18018.00

ever, that in the balance sheet shown a mistake had occurred in entering the balance of Jones, Kipp & Lane by transposing the figures to read $41.05. The total in the credit column of the trial balance would then have exceeded the total of the debit column by $27, the sum of whose digits is nine. Whenever the totals in the two columns differ, if the sum of the digits in the amount representing the differences is nine, or a number divisible by nine, it is a reasonably certain indication that there has been a transposition of figures either in the trial balance or in the ledger entries.

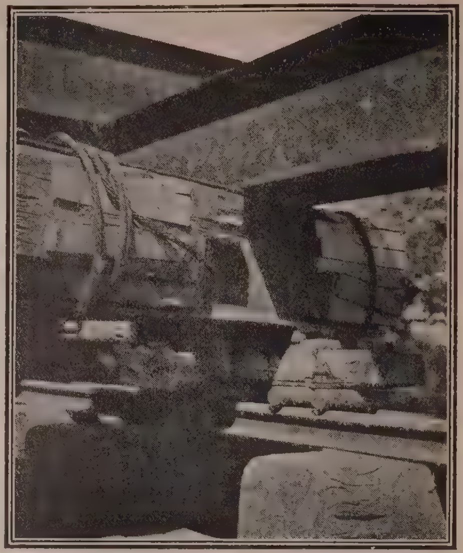
Another test often used by bookkeepers when the trial balance sheet fails to check is to divide the difference between the debit and credit columns by two. If the difference is so divisible, it indicates that a mistake has probably been made by entering an account on the wrong side either of the trial balance or of the ledger.

1450-Ton Apartment House Moved 80 Feet on High Cribbing

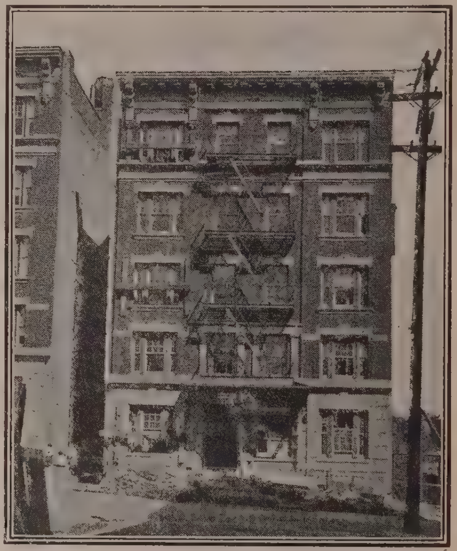
A brick apartment weighing 1450 tons has been moved two lots downhill from 950 Anderson Avenue, New York City, and lowered 12 ft. to a new foundation, rather than underpinning it in constructing the west portal of the tunnel section of the Eighth Avenue-162d Street connection of the Interborough Rapid Transit extensions, the portal being directly in the rear of the old location of the building. A new two-story store building and station will be constructed on the site after the tunnel is completed.

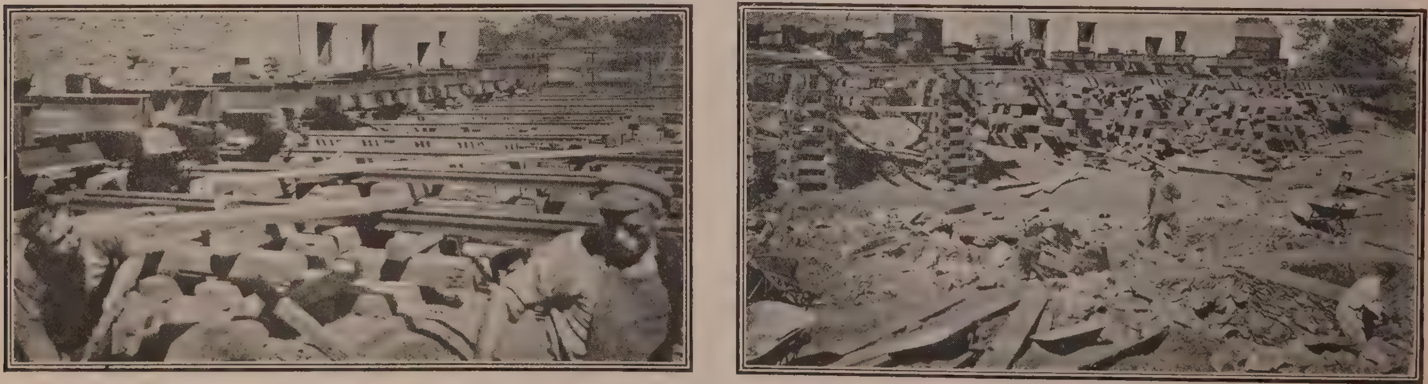
As the five-story apartment, 88 ft. deep with a front of 40½ ft., is entirely of brick and wood, with no steel frame, it was needled on each side of each vertical row of door and window openings. Under the side walls two sets of beams, the lower parallel to and the upper through the walls, were placed. On top of the upper row was set a third row carrying the front and back walls. A center wall was carried by the second row of beams. The top beams were grouted to a bearing all around and the building raised with shoring jacks spaced 5 ft. apart till the steel-shod roller bearings, 2¼-in. cast-iron rollers and rail tracks could be set. The building was then lowered and the basement walls torn down.

This part of the work was finished between April 19 and June 1, on which date the building was shoved 12 ft. south, sidewise, by seven shoring jacks braced against the apartment adjoining on the north. As the new site is downhill from the old, heavy cribbing had to be built for the tracks. This could not all be done in advance without interfering with the work of building the new foundations. The move was completed on June 26, having been delayed by bad weather and the building is now being lowered to place.


DETAIL OF ROLLER NEST AFTER 10 FEET OF TRAVEL

This section of the Eighth Avenue-162d Street connection is being constructed by the Battery Engineering Corporation under the direction of the Interborough Rapid Transit Company, of which George H. Pegram is chief engineer, F. W. Gardner principal assistant engineer and O. C. Whitman resident engineer. The apartment is being moved under a separate contract with Charles Money. The moving operations were sublet to the Rudd-Nilson Company.


THIS BUILDING WAS MOVED 80 FEET


NEEDLING AND RAILS ON SOUTH SIDE OF BUILDING AT LEFT—RIGHT, MOVE BEING MADE ON TALL CRIBBING, NEW FOUNDATION IN FOREGROUND

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Civil Engineers Meet in Pittsburgh This Week

Annual Convention, as Usual, Is Almost Exclusively a Social Affair—Committee Activities Discussed—Attendance 600

A program of varied interest marked the convention of the American Society of Civil Engineers at Pittsburgh this week. According to custom, there were but two business sessions, at one of which Clemens Herschel, who succeeded to the presidency on the death of Dr. Corthell, delivered the presidential address. Extracts from the address, the chief theme of which was the advisability of carrying on the planning, construction and administration of public works by public-works departments managed by engineers, will be found elsewhere in this issue. The social activities included an inspection tour by boat of government locks and dams; alternative inspection trips, according to the tastes and interests of the delegates, to thirteen different industrial plants; a cross-country automobile tour; a dinner and a ball.

Business Meetings

The first of the business meetings was given over to addresses of welcome, an address by John A. Brashear, past-president of the American Society of Mechanical Engineers, and the presidential address. Dr. Brashear, introduced as the foremost citizen of Pennsylvania, a distinction conferred on him by vote of representatives of the state last year, spoke in his usual happy way on the relation of science and engineering. With anecdote and reminiscence he illustrated his contention that pure science and applied science must ever go hand in hand. The line of demarcation between them, if ever there was one, has disappeared. He suggested closer relations between the engineering societies and those devoted to pure science.

At the second business meeting, on Tuesday afternoon, the vote on the proposal to move the headquarters of the society to the Engineering Societies Building was announced. It is given elsewhere in these columns.

J. Vipond Davies, director of the society and chairman of the board's committee on special committees, laid before the meeting the difficulties which the board of direction was having in securing from the special committees reports as to what they were doing. He cited as particularly flagrant the failure of the committee on concrete and reinforced concrete even to acknowledge the receipt of letters, much less to give the information requested. He, therefore, moved that this committee be discharged. An extended discussion on the work of the committee ensued. Prof. A. N. Talbot detailed what the committee has been doing since last October, and Mr. Davies replied that if this information had been forthcoming from the chairman or the secretary of the committee there would have been no reason for his motion. Various substitute motions and amendments were proposed, but eventually the entire matter was laid on the table.

The matter of time and place of the next convention was referred to the board of direction with power to act. The secretary explained that a committee of the board is now working on a plan to route the convention to each of the thirteen districts, so that this matter would then be settled for years in advance.

Resolutions, striking for their sincerity and depth of feeling, were adopted on the death of Dr. Corthell. Past-presidents Swain, McDonald and Ockerson composed the resolutions committee.

Alfred Noble Memorial

Onward Bates, past-president and chairman of the committee on the Noble memorial, reported that Congress had granted a site for the monument, which is to be symbolic in character, on New York Avenue, in Washington, D. C., opposite the new Interior Department Building now under construction. The sculptor commissioned to prepare preliminary designs was to report to the committee at Pittsburgh this week. As soon as consistent with the character of such an assignment the committee expects to report a design to the profession and open subscription books.

About six hundred members and guests had registered at the close of the first day of the convention.

Civil Engineers Vote to Move Society's Headquarters

Result of Letter Ballot of Membership Shows Overwhelming Majority in Favor of Removal to Thirty-ninth Street

The American Society of Civil Engineers will move its headquarters from its present building on Fifty-seventh Street, New York City, to the Engineering Societies Building. That is the result of the ballot of the membership which closed June 15 and was announced at the Pittsburgh convention of the society on Tuesday of this week. The vote was 6 to 1 in favor of the removal of headquarters. In all 2963 ballots were counted. Of these 2500 voted favorably on the question whether the society should move and 390 in the negative.

The ballot not only asked for a vote on this question, but also on the detail plan favored. Plan A calls for the addition of two and a half stories to the present building of the Engineering Societies, the American Society of Civil Engineers to pay for the addition up to a cost of $250,000; 1096 ballots favored this plan and 248 were opposed. Plan B provided for keeping the Engineering Societies Building as it is to-day, the civil engineers paying into the treasury of the United Engineering Society the sum of $240,000; 194 members favored this plan and 695 were against it. The votes on plans A and B, therefore, reinforce each other.

On the final question, whether the matter should be left to the board of direction, the vote was 1795 affirmative and 524 negative.

Reorganization Plan of Western Pacific Is Approved

In a lengthy decision handed down June 23 the Railroad Commission of California approved the reorganization plan of the Western Pacific Railway which provides for the sale of all its property to the new Western Pacific Railroad Company, the issue of $75,000,000 of stock and $20,000,000 of bonds by the latter corporation, and the mortgaging of the property to secure an authorized bond issue of $50,000,000. The order hinges upon the Western Pacific Railroad Company's being the successful bidder for the property of the Western Pacific Railway Company in the foreclosure proceedings and sale. The decision commends the plan as one having a fair chance to succeed. The articles of incorporation of the new company confer power specifically to purchase or build about 350 miles of branch lines.

Clemens Herschel Presides at Civil Engineers' Meeting

A Short Biography of the Eminent Hydraulic Engineer Who Succeeded to the Presidency on the Death of Dr. Corthell

Clemens Herschel, who succeeded Dr. E. L. Corthell as president of the American Society of Civil Engineers and presided at this week's annual convention of that association in Pittsburgh, is best known for his work in the field of hydraulics. His experiments in 1887 led to the invention of the Venturi meter and the derivation of the well-known formulæ for calculating the flow through large pipes.

The principle upon which the Venturi meter is founded was first announced in 1797 in the published researches of J. B. Venturi, an Italian philosopher. He had observed that fluids discharging through an expanding nozzle exert a sucking action at the smaller diameter which diminishes as the diameter increases toward the outlet. It is apparent that he considered this phenomenon scientifically interesting but without practical value. Following Venturi, other engineers made occasional use of the peculiar property for various purposes.

Presiding Officer at Civil Engineers' Convention

CLEMENS HERSCHEL

In 1887 Clemens Herschel conducted a series of the tests was to determine whether a defsizes of tubes composed of two conical portions joined at their small ends, thus forming a contraction near the middle. The purpose of the tests was to determine whether a definite relation existed between the difference in pressure at the inlet and contracted section and the rate of flow. Such remarkably uniform results were obtained that he patented the device, giving it the name of Venturi meter.

Mr. Herschel was awarded the Elliott Cresson gold medal by the Franklin Institute for his invention, as described in the February, 1899, issue of the proceedings of that society. He was also presented with the Rowland prize by the American Society of Civil Engineers.

Mr. Herschel was born in Davenport, Iowa, in 1842. After graduating from Harvard University in 1860 he spent three years studying in France and Germany, being graduated from the Carlsruhe Polytechnic School in 1863. Upon his return to Boston in 1864 he took up the practice of consulting engineering, devoting most of his time to bridge work. In 1872 he was appointed superintendent of streets of West Roxbury, Mass.

In 1879 he entered the field of hydraulic engineering, in which he was destined to win world-wide recognition. As hydraulic engineer for the Holyoke (Mass.) Water Power Company he practically rebuilt the dam across the Connecticut River at that point and conducted many hydraulic experiments on a large scale, which resulted in the development of the Venturi meter as just outlined.

He became engineer and superintendent for the East Jersey Water Company in 1889 and undertook the construction of the works for that company. In two and one-half years he had completed the 80,000,000-gal.-a-day plant which supplies water to a group of New Jersey's cities and towns. He left the East Jersey Water Company in 1900.

Mr. Herschel was one of the three railroad commissioners of Massachusetts from 1881 to 1883. Since 1884 he has been consulting engineer on many of the largest power developments at Niagara Falls. Since its inception he has been hydraulic engineer for the Cataract Construction Company, whose works at Niagara Falls utilize about 100,000 hp. He has also acted as consulting engineer for the Niagara Falls Power Company and the Canadian Niagara Falls Power Company.

Author of Several Books

Aside from his experimental hydraulic investigations Clemens Herschel has contributed to technical literature. His volume on "Continuous Revolving Draw Bridges" was published in 1875. His most noteworthy work is "The Two Books on the Water Supply of the City of Rome, of Sextus Julius Frontinus," which contains the only photographic reproduction of the sole manuscript of Frontinus' "De Aquis" and the first translation into English ever made. It is said that this quarto book represents twenty years' collection of material for its publication.

The fineness of character and breadth of view of Mr. Herschel are exemplified by the self-effacement with which he coupled his own invention—the Venturi meter—with the name of that long-forgotten engineer who, but for this generous act, would have remained in oblivion.

Mr. Herschel is past-president of the Boston Society of Civil Engineers and a member of the Institution of Civil Engineers of Great Britain, in addition to holding a membership in many social organizations.

Engineers Want Unused Water Powers Developed

A letter dated June 28 from the Joint Conference Committee of National Engineering Societies, representing about 30,000 engineers, to the President of the United States reads as follows:

"The Joint Conference Committee of National Engineering Societies believes that the development of the country's undeveloped water power will increase national prosperity; that private enterprise should be encouraged and stimulated to expedite such development; that unnecessary legal burdens should be removed and existing doubts as to the safety of investment eliminated. It commends to the support of engineers all efforts to secure the fullest publicity as to the underlying facts regarding this subject."

A. A. Stevenson President of Testing Society

Has Been Connected with Standard Steel Works Company Since 1888—Prominent in Steel Business and Society's Activities

Archibald Alston Stevenson, vice-president of the Standard Steel Works Company since 1908, was elected president of the American Society for Testing Materials at the June 27 meeting at Atlantic City. He succeeds A. W. Gibbs. Mr. Stevenson is the first president of the society selected from the producing interests.

Mr. Stevenson was born in Allegheny City, Pa., in 1862. He was graduated from high school at Rock Island, Ill., in 1878, after which he spent a year as rodman on a government survey of the Mississippi River. He then studied at the University of Illinois for two years. He again took up active work in 1880 in the drafting room of the Southwark Foundry & Machine Company, Philadelphia. After three and one-half years with that company he was put in charge of the drafting room.

First President of American Society for Testing Materials to Be Selected from Producing Interests

ARCHIBALD ALSTON STEVENSON

He left the employ of the Southwark company after four and one-half years' service to go to the Cambria Iron Company, where he was employed for two and one-half years, part of which time he spent in the chief engineer's office and the remainder as foreman of the forge and axle plant. He entered the employ of the Standard Steel Works Company in 1888 as engineer. He rose to the position of superintendent in 1903 and in July, 1908, was made vice-president of the company.

Mr. Stevenson was vice-president of the Association of American Steel Manufacturers from 1908 to 1911 and president from 1911 to 1914. He is a member of the American Society of Mechanical Engineers, American Institute of Mining Engineers, International Association for Testing Materials and the Engineers' Club of Philadelphia.

Dams Break at Kalamazoo

A heavy rainstorm June 24 at Kalamazoo, Mich., caused heavy floods which wrecked the dams at the Bryant and Monarch paper mills. Twenty-six blocks in Kalamazoo's residence district were flooded. No lives were lost.

Testing Society Meets at Atlantic City This Week

In spite of the conflict of dates with the convention of the American Society of Civil Engineers at Pittsburgh, the registration of 375 for the first day of the nineteenth annual meeting of the American Society for Testing Materials at Atlantic City, June 27-30, exceeded that of last year by 140. At the business meeting on Tuesday morning the annual report of the executive committee was received and ordered printed without change. The reports of the committee on standing committees, the committee on wrought iron and the committee on papers and publications were also presented.

The following officers for the ensuing year were elected: President, A. A. Stevenson, vice-president of the Standard Steel Works Company of Philadelphia; vice-president, S. S. Voorhees, engineer-chemist, U. S. Bureau of Standards, Washington, D. C.; members of the executive committee (to serve two years), W. H. Bassett, chemist, American Brass Company, Waterbury, Conn.; John Brunner, assistant inspecting engineer, Illinois Steel Company, Chicago; G. W. Thompson, chemist, National Lead Company, Brooklyn, and F. E. Turneaure, dean of the College of Engineering, University of Wisconsin. This is the first time that a representative of the producing interests has been elected president of the society. A sketch of Mr. Stevenson's career is given elsewhere in this issue and an editorial on the significance of his election was published in the Engineering Record of May 6, page 597.

New Public Health Association Formed in Illinois

As an outgrowth of the public-health session of the Better Community Conference held recently at the University of Illinois, a new society—the Illinois Association for Public Health and Welfare—has been launched to organize the 400 health officers in Illinois, the sanitary engineers and all persons and firms in the State who are interested in public health and welfare.

The officers of the association are as follows: Honorary president, Dr. Robinson; president, Dr. G. T. Palmer; vice-presidents, W. J. Allen, Dr. A. C. Clarke and Dr. Ruediger; secretary-treasurer, Paul Hansen, chief engineer, State Board of Health, Springfield.

New England Waterworks Convention Sept. 13 to 15

This year's convention of the New England Waterworks Association will be held Sept. 13 to 15 in the city hall at Portland, Me. Arrangements are under way for transportation of the delegates by rail or boat. Excursions to points of interest near Portland have also been planned.

Gov. Oakley C. Curtis of Maine and possibly Admiral Peary will address the meeting at its opening. The exhibit, in charge of W. F. Woodburn, will be held in the auditorium of the city hall.

Jersey Supreme Court Sustains Grade-Crossing Law

The Fielder grade-crossing law of 1913, which authorizes the New Jersey Board of Public Utility Commissioners to order the elimination of grade crossings within the state at the railroad's sole expense, was declared constitutional by the state Supreme Court in a decision rendered June 23. The order at issue was that directing the Erie Railroad to eliminate fifteen grade crossings in Paterson at an estimated cost of approximately $3,000,000. H. A. Taylor, general attorney of the Erie, states that the matter will be carried to the Court of Errors and Appeals.

$2,085,000 to Be Spent on Hetch Hetchy Project

Time and Cost Estimates and a Construction Schedule Are Announced by Chief Engineer O'Shaughnessy

The project which is to bring 400,000,000 gal. of water per day to San Francisco from the Hetch Hetchy Valley, 181 miles away, is now well started. The site of the dam is to be unwatered late this fall and work will be begun simultaneously on several parts of the project, giving particular attention to those points where progress will be restricted the most. An estimate of yearly costs and a tentative outline of the construction program have just been prepared by M. M. O'Shaughnessy, from which the following has been taken.

During 1916 the principal activities will be building the construction railroad for which the contract has already been awarded; completing the diversion tunnel and diversion dam; preparing foundations for the main dam; laying out a temporary power plant to supply electric current for the construction operations at the dam site; continuing the aqueduct tunnel from Early Intake toward South Fork; making diamond-drill borings along the tunnels and continuing the minor incidental work.

$120,000 for Temporary Power Plant

Power for construction use will be developed about 12 miles from the dam site, where water can be diverted from Cherry River and led through a canal to a point near Early Intake, where the temporary plant will be built. A high tension transmission line will connect this plant with the dam site and another line, 20 miles in length, will follow along the aqueduct line as far as Moccasin Creek, with a substation at each portal, shaft and adit of the tunnel aqueduct. The canal will have a capacity of 200 cu. ft. per second and will be a permanent structure, remaining in service to make Cherry Creek tributary to the tunnel aqueduct.

The construction work outlined for this year is estimated to total $2,085,000, apportioned as follows: Hetch Hetchy railroad, $1,650,000; Hetch Hetchy reservoir, $160,000; temporary power plant, $120,000; Early Intake tunnel, $50,000; San Joaquin Valley pipe line, $5,000; Coast Range tunnel, $10,000; lands and rights, $25,000; general engineering and legal expenses, $65,000. The total cost of the project is given at $44,147,000, of which $2,267,000 has already been expended and the remainder is to be distributed among the next eight years with a maximum of $8,900,000 in 1921.

Engineers Have Opportunity to Receive Military Training

A depot battalion is organizing at the 71st Regiment armory, New York City, to hold the fort for that regiment of the National Guard while it is on border duty. Lieut.-Col. E. B. Bruch, commander, and First Lieut. Burton G. Wager, adjutant, unofficially announced that any engineers desiring to receive military training, including those who have been under instruction of 71st Regiment officers, will be welcomed to this detachment.

St. Louis Engineers Organizing an Engineers' Battalion

Following a call by John A. Laird engineers of St. Louis met June 23 at the Engineers' Club of St. Louis for the purpose of organizing an engineers' battalion for service in the Mexican campaign. The adjutant general of Missouri has given his assurance that every inducement will be given for such an organization. About 30 members enrolled that evening. It is expected that this number will be considerably increased as the movement is carried forward.

California Engineers' Battalion Forming for Mexican Service

An engineer battalion of three companies, with a full complement of 519 officers and men, is being organized in California for duty on the Mexican border. The battalion is officered by members of the California engineer corps and the organization and recruiting are under the direction of Major J. W. Swaren, of the Pelton Water Wheel Company. On June 23, after only a few days of activity, about 75 per cent of the requisite number of men had been recruited, and the number of candidates was rapidly increasing. Only men who have had some training which will enable them to serve effectively on an engineer corps are accepted.

Photo Courtesy Chicago Daily Journal.

Illinois Engineers Company Leads Way to Mobilization Camp

COMPANY A, Corps of Engineers, led the Chicago military procession to the mobilization camp at Springfield, June 21. Four passenger cars, two flat and two box cars loaded with equipment and supplies left on the Chicago & Alton Railroad at 7 a. m. June 21. Motor trucks furnished by the city transported the impedimenta, consisting of complete equipment for reconnaissance, bridge-building and demolition, from the armory to the railroad yards. Due to a cloudburst, the first work at the camp was that of drainage trenching. Capt. H. B. Sauerman, who organized Company A, is now engaged in developing two additional companies provided for under the new law which goes into effect July 1. He will also receive recruits for Company A, which needs about seventy-five men to bring it up to war strength.

Railroad Appoints Representatives to Assist in Mobilization

The New York, New Haven & Hartford Railroad has appointed four representatives to co-operate with the government in mobilizing of troops and handling supplies. L. DeB. Lovett, resident engineer, has been assigned to duty at the Framingham (Mass.) camp.

Caisson Bursts in Boston Tunnel

Four men were killed June 24 when a caisson used in the construction of a section of the South Boston tunnel at L and Summer Streets was wrecked by an explosion. A leak in the 80-ft. air shaft is said to have been the cause of the accident.

Extra Indexes Available

To meet the desires of those who like to bind their indexes to the Engineering Record separately, and still have each volume indexed, a limited number of the indexes of Vol. 73, January-June, 1916, have been printed. As long as the supply lasts they will be given out free on application.

$22,000,000 San Francisco-Oakland Bridge Proposed

Plans Will Soon Be Presented for Structure 5½ Miles Long—Propose Location Where Average Depth Is 60 Feet

The U. S. War Department has announced a public hearing to be held in San Francisco in the near future before Col. Thomas H. Rees, Corps of Engineers, U. S. A., at which plans for the $22,000,000 San Francisco-Oakland bridge will be presented and the project explained. The proposition is advocated by Harlan D. Miller, bridge engineer, of Albany, N. Y., and has been indorsed by numerous civic bodies in the bay cities.

It has been pointed out that a 5½-mile structure connecting First and Adeline Streets in Oakland with Second and Townsend Streets in San Francisco would be the shortest route. It would also reach the San Francisco shore beyond the last important pier, so that the bridge would not interfere with the shipping. The 60-ft. depth of water and weak currents are also cited as conditions favorable to the proposed location. Trains could be run on subway or elevated tracks direct to a terminal at Third and Market Streets, delivering passengers into the heart of the city.

The bridge would consist of a large number of spans all alike, except two near the San Francisco shore, where exceptionally long and high spans would be necessary to permit the unobstructed passage of ships. There would be two bascule spans in the bridge, one near each shore. Three roadways would be provided, one for high-speed auto traffic and two for trucking. Provision is to be made for steam-line and interurban electric railroad tracks with grades and curves, permitting a speed of 45 miles per hour. Interlocking safety devices similar to those on the New York subways would be expected to allow a headway of 1½ min. between trains.

It is urged that the bridge be built jointly by the counties of Alameda and San Francisco as a public highway, and a small toll be collected for its use. Because of the heavy traffic that is expected it is estimated that the tolls would pay for the bridge in about ten years. The estimated cost of the structure is $22,000,000 and the expected annual revenue $3,450,000. Based on charges of 30 cents for each vehicle and 2 cents for each passenger on the railroads, the revenue would be distributed as follows: Passengers, $1,200,000; automobiles, auto trucks and other vehicles, $1,500,000; passenger coaches, $675,000; conduits, electric wires, cables, $75,000. Bonds would have to be issued to cover the cost of construction. The Oakland Chamber of Commerce estimates that the interest on ten-year bonds would be $1,000,000 per annum, leaving more than $2,000,000 to be applied to the sinking fund and for retiring the bonds.

Heavy Floods Cause Serious Damage in Pennsylvania

Recent heavy floods on the Susquehanna River watershed caused hundreds of thousands of dollars loss to crops, railroads and manufacturing plants along that river and its branches. Several small dams broke at Lawrenceville, Pa., inundating the town to a depth of 4 ft. To prevent an outbreak of disease the state health department dispatched medical officers, two sanitary engineers and a corps of health officers from Harrisburg and nearby points.

The Juanita River at Lewistown is said to have risen June 18 21.6 ft. above low-water mark. Slides of earth blocked highways and railroads. The waters of Tuscarora Creek washed away an abutment of a bridge of the Tuscarora Valley Railroad. An engine and three cars plunged into the stream, killing the fireman and engineer.

Landslides held up traffic on the Central, Renova and Middle divisions of the Pennsylvania Railroad. At Spruce Creek, Pa., a slide derailed a fast passenger train, but no one was injured. At Harrisburg the flood caused suspension of work on the New Cumberland Valley Railroad bridge being constructed by the Robert Grace Construction Company. Several sections of the temporary trestles are reported to have been swept away by the high water.

$3,000 Model of Riverside Park Track Plan Will Be Made

A $3,000 model is to be made of the track and tunnel plan along Riverside Park proposed by the New York Central Railroad as part of the West Side improvement in New York City. The order for its construction has been issued by the Board of Estimate. It will require several weeks to complete the model, which is expected to give various interested civic bodies a better understanding of the extent of the park changes.

Purdue University Starts Series of News Letters to Alumni

The first of a series of news letters to be sent out by the heads of the engineering schools of Purdue University to the alumni was mailed recently. The object of the campaign will be to keep the graduates in touch with the activities of the schools and develop a spirit of mutual support between the alumni and faculties.

St. Louis Engineers Made Members of Bond Election Committee

Out of a committee of thirty-one men chosen recently in St. Louis at the mayor's conference to arrange details for a bond issue campaign, five were members of the St. Louis Engineers' Club—Edward Flad, Julius Pitzman, F. G. Jonah, C. E. Smith and J. T. Dodds. The committee will make a comprehensive report to the conference the second week in July.

Mayor of St. Paul Appoints Engineer to Membership in Advisory Board

A new idea in city government is that being put into effect by V. R. Irwin, mayor of St. Paul. He is forming a mayor's advisory board, composed of representatives of all large civic organizations. Among the associations asked to elect a member to the board was the Civil Engineers' Society of St. Paul. P. E. Stevens, consulting engineer of that city and secretary of the St. Paul society, was appointed to represent the civil engineers on the mayor's advisory board.

New Haven Seeks to Enlarge Freight Cut at Boston

Plans have been prepared by the New York, New Haven & Hartford Railroad for widening the two-track cut leading to the freight terminals at Boston. The intention is to four-track the connection. Plans are now before the city authorities for approval. It is estimated that the improvement will cost $829,000 and require eight months to complete.

Good Roads Association Formed

The State Good Roads Association of Pennsylvania was formed June 26 at Harrisburg. The officers are: President, R. L. Munce, Canonsburg; secretary, A. A. Purman, Waynesburg; treasurer, W. H. H. Davis, West Chester.

$20,000,000 Flood-Prevention Project Being Considered

The Pittsburgh flood commission has been asked by Gov. Martin C. Brumbaugh of Pennsylvania to submit to him drafts for legislation to bring about co-operation between the city of Pittsburgh, Allegheny County, the commission and the national government in the construction of flood-prevention reservoirs on the Monongahela and Allegheny rivers, establishing seventeen reservoirs in Pennsylvania, Maryland and West Virginia to impound flood waters. The project will call for an expenditure of $20,000,000. Surveys have already been made. Bills will be drafted for presentation to the Pennsylvania Legislature in 1917.

Reconstruction of Paris, Tex., Progresses Rapidly

Paris, Tex., almost completely destroyed by fire last March, is rapidly being rebuilt. The court house and municipal buildings are already under construction and plans are being considered for about fifty new business houses. It is estimated that nearly $5,000,000 will be spent during the next year or so for buildings.

Not Wanted at Any Price

Pinned to a circular bearing the caption, "The Last Chance to Buy Engineering Record at $3 a Year," which further set forth the saving of $2 that would be garnered by the thrifty who subscribed before June 15, the circulation department of this journal received the subjoined repudiation of its arguments:

———. Colorado. June. the 5 1916.

to the last chance

dear surs your second note at hand and would say in advanse or rather in reply that I am vary mutch obliged to you for the intrest you seam yo manefest in my behaf in giving me a tip in regards to the raising of the rates of your paper but I do not want your paper at eny prise so you can rest contented and asshured that I will not be disapointed if the prece does go up to 10 $ insted of 3 $ so do nnot waste eny more stamps mailing special tips I have lived quite A number of years with out the assistance of the valyable information of your paper and rather thi nk i can get along likley the rest of my days byt if I should fale I then would send the proper amount for the assistance of the vary valuable paper so hoping you will not be vary mutch disepointe in not recieving the amount of my subscription and I know you will not becose if the paper si worth $5 you would simpley bee giving me $2 and that I would never stand for I am no pawper and dont think I will bee soon so good by from one that is vary mutch interested in your willfaie but more so in my own

yours vary truley
at ——— Colorado

First Successful Aeroplane Shown at Tech Dedication

Among the remarkable exhibits in the Museum of Technology at the recent dedication of the new buildings of the Massachusetts Institute of Technology was that of the first aeroplane to fly under its own power. The original Wright machine, which made its first power-driven flight of 12 sec. duration Dec. 17, 1903, was seen by the public last week for the first time.

Idaho Engineers Issue Journal

The first number of the *Idaho Engineer* is dated May, 1916. The new journal is published by the Idaho Society of Engineers, at Boise, Idaho. A page entilted "Rod Up" sets forth the policy of the journal as follows:

"The Idaho engineers are up in Boundary County tying in a preliminary to the Canadian line; they are in the Cœur d'Alene mines driving a drift on the 1500; they are at Lewiston building a highway on Union Town Hill; they are making a topog map in the Potlatch timber; they are staking out a placer claim in the Boise Basin or locating the corners for a stockman down in Owyhee County; they are putting in 10,000 hp. on the Snake River; they are building a power line in Bear Lake County—measuring water from the Magic Dam or storing water near the Wyoming line.

"Is it any wonder they seldom meet to talk it over?

"This *Idaho Engineer* wants you to know each other—to know what's doing—what the fellow in Boundary as well as the one in Bear Lake County thinks about it—what you think about it and what we all think about it, so that the Idaho Society of Engineers may think together, do together and accomplish together."

Plan Memorial to Late J. J. Hill

The adoption of a plan to convert an entire business block in that city into a memorial to the late James J. Hill is being urged by the St. Paul Association of Commerce. The project is said to involve the expenditure of more than $1,000,000, funds to be contributed from all over the country. The proposed site for the memorial square is the block between Fourth, Fifth, Sibley and Wacouta Streets.

Award Elliott Cresson Medal

The Franklin Institute has awarded the Elliott Cresson gold medal for 1916 to Dr. Robert Gans of Pankow, near Berlin, Germany, for the discovery of Permutit. The medal and diploma are awarded annually by the institute on the recommendation of its committee on science and arts "for discovery or original research adding to the sum of human knowledge irrespective of commercial value or products embodying substantial elements of leadership in their respective classes, or unusual skill or perfection in workmanship."

Floods Wash Out Bridge

Several creeks in Grant County, Oregon, overflowed last week and are said to have carried away several bridges. Floods on the west fork of the Hood River destroyed a bridge crossing that stream near the town of Hood River, Ore.

Portland Cement Included in Pavement Classification

The New York Board of Estimate and Apportionment recently included Portland-cement concrete in the classification of ordinary pavements. The board's decision was that "Portland-cement concrete pavements not less than 6 in. thick may also be laid as a preliminary pavement on streets and roads in undeveloped districts under conditions to be prescribed by the board in each particular case."

Engineering Society Activities

The Engineers' Club of St. Louis held a meeting June 28 at which F. R. McMillan, assistant professor of structural engineering at the University of Minnesota, presented an illustrated paper on time tests of concrete.

The Colorado Association of Members of the American Society of Civil Engineers elected the following officers June 10: T. W. Jaycox, president; Robert Follansbee, vice-president, and L. R. Hinman, secretary-treasurer.

The Better Community Conference at the Illinois State University June 20, 21 and 22 was addressed by Paul Hansen, chief engineer of the state board of health, who spoke on "Water Supply and Sewerage." S. A. Greeley, consulting engineer, of Chicago, discussed city wastes collection and disposal.

The Seattle Master Builders' Association, at its recent annual meeting, elected the following officers to serve for the ensuing year: C. C. Cawsey, president; Neil McDonald, vice-president; E. H. Jones, treasurer; C. W. Carkeek, secretary. George Eckman, M. J. Hursen and Otto Roseleaf were appointed trustees.

The Pacific Northwest Society of Engineers, at a recent meeting at Seattle, continued the discussion of tests of concrete floor slabs used in the construction of the Bell Street warehouse at Seattle. Papers were received from Prof. W. A. Slater, University of Illinois, and Prof. F. R. McMillan, University of Minnesota, and also from C. A. P. Turner and V. H. Fixen.

The Engineers' Society of Pennsylvania has inaugurated for the first time a state-wide campaign for additional members. A membership committee headed by William B. McCaleb, superintendent of the Philadelphia division of the Pennsylvania Railroad at Harrisburg, is making a vigorous canvass of engineers in every part of Pennsylvania. Subcommittees have been appointed in each of the state's sixty-seven counties, and an effort will be made to double the present membership of approximately 700 in thirty days. The Engineers' Society of Pennsylvania holds a particularly important position among engineers of that state because of the location of its clubhouse in Harrisburg, the state capital. The society has been active for ten years.

Engineers of Peoria, Ill., met June 15 in that city to discuss the formation of an engineers' club. The second meeting is scheduled for June 26.

The Engineers' Club of Cincinnati recently held a joint meeting with the local section of the American Society of Mechanical Engineers. Major P. S. Bond, Corps of Engineers, U. S. A., discussed preparedness from the engineer's point of view. The next meeting will be held in October.

The Engineers' Club of Seattle, at the regular weekly meeting June 15, heard C. Alan Dale, city councilman of Seattle, lectures on "Councilman Life from the Inside."

The Engineers' Society of Pennsylvania held its regular meeting June 16, at Harrisburg. The next gathering will be in September or October.

The Engineers' Club of St. Louis, at the June 21 meeting heard S. W. Bowen, chief designing engineer of the department of public utilities of St. Louis, present an illustrated paper on a proposed municipal river terminal system for the city of St. Louis.

The Rochester Engineering Society has added a number of books on military preparedness to its library. The society has been active in military work and boasts fifty members who belong to the engineering reserve of New York State.

What Engineers and Contractors Are Doing

Arthur B. Morrill, formerly employed at the sewage-disposal plant of the Baltimore Sewerage Commission, has become associated with Morris Knowles, consulting civil engineer, of Pittsburgh.

Frank J. Engel and Herman P. Hevenor have opened offices at 220 Broadway, New York City, under the firm name of Engel & Hevenor, engineers and contractors. Mr. Engel is a graduate of the University of Pennsylvania and has spent most of his time in railroad work with the Pennsylvania and the Boston & Albany railroads. In 1912 he went to the American Bridge Company, at Pencoyd, Pa., but in 1913 took a position in the bridge department of the Boston & Albany Railroad, assisting in the design and field work connected with the renewal of many of that road's large bridges. When the valuation department was organized he was transferred to that division with the title of assistant engineer, from which position he recently resigned. Mr. Hevenor has been connected with the Brooklyn Rapid Transit Company as assistant engineer on estimating, designing and following up of that company's contractors' construction. Later he had entire charge of the design and construction of the track department of the Buda Company at Harvey, Ill. For the past five years he has been in the chief engineer's office of the New York, New Haven & Hartford Railroad, working on design, investigations and inspections.

Victor H. Cochrane, of Hedrick & Cochrane, consulting engineers, of Kansas City, Mo., has been made engineer of structural steel work for that city. Mr. Cochrane is a graduate of the University of Arkansas. In 1901 he became connected with Waddell & Hedrick, consulting engineers, of Kansas City, and in 1903 was made chief draftsman. In 1905 he was made representative of his firm at the Riter-Conley Manufacturing Company's shops at Pittsburgh, in charge of inspection of steel for the Intercity viaduct. In 1906 he was appointed assistant engineer for Ira G. Hedrick, consulting engineer, of Kansas City. A year later he took a similar position with Waddell & Harrington. While in that firm's employ he had charge of the estimating and designing of bridge work costing nearly $5,000,000.

G. Stewart Giles, formerly connected with the Carolina Mineral Company of Penland, N. C., has been made inspector for the Underwriters Bureau of the middle and southern states, with headquarters in New York City.

John G. Mason, formerly connected with the bridge department of the Chicago, Burlington & Quincy Railroad, has been made structural engineer in the supervising architect's office at Washington, D. C. Mr. Mason is a graduate of the University of Nebraska. Previous to his employment by the Chicago, Burlington & Quincy he was for two years inspector for the state bridge engineer of Nebraska. Mr. Mason has also had four years' experience as chief draftsman for the Westover Iron Works, Lincoln, Neb.

Joseph O. Droffin, who has for two years held a research fellowship at the University of Illinois, has just completed his studies at the engineering experiment station at that university and is now connected with McIntosh & Crandall, civil engineers, of Burlington, Vt.

W. Graham Cole, formerly assistant engineer for the Baltimore Sewerage Commission, has been made safety engineer for the Maryland Steel Company at Sparrow's Point, Md.

R. H. Hutchinson, superintendent for R. H. & G. A. McWilliams, drainage contractors, of Chicago, will have charge of the levee work at Stamps, Ark., for which his company recently secured the contract. Mr. Hutchinson is now completing the construction of 18 miles of levee along the Red River in Miller County, Arkansas, involving the excavation and depositing in embankments of nearly 1,300,000 cu. yd. of material.

S. A. McGovern has resigned as assistant engineer in charge of location and design of county drainage ditches in Brown County, Minnesota, to become assistant engineer on a 122,000-yd. paving job at Ames, Iowa.

James E. Sutton, formerly city engineer of Alameda, Cal., has been chosen by the city of Taft, Cal., to lay out and supervise the construction of its streets. A $60,000 bond election will be held soon and if it carries Mr. Sutton will be in charge of the street building work.

Edward L. Zeltner has entered the employ of the U. S. government in the ordnance department of the navy yard at Washington. Mr. Zeltner has been with the C. W. Hunt Company, New York City; the Turner Construction Company and the Canadian Copper Company.

Louis Focht, engineer in the New Jersey department of taxes and assessment, has been appointed with Willis Whited, engineer of bridges for the Pennsylvania highway department, to estimate the value of the toll bridges spanning the Delaware River between Trenton and Port Jervis. Mr. Focht first took up engineering work in 1882 in the engineering department of the Lehigh Valley Railroad, where after fourteen years he rose to the position of assistant engineer in full charge of all work on the New Jersey division. He resigned to become chief engineer for the Lehigh Construction Company, after which he was employed on railway investigations in South America. He returned to the United States to become chief engineer and superintendent of the New Jersey Terminal Railway and was later made assistant chief engineer of the Mount Desert Transit Company, after which he became connected with the State of New Jersey. He was appointed chief engineer to Charles Hansel, consulting engineer, in 1910.

Melville H. James, secretary of the William Penn Highway Association, has made his headquarters in the Telegraph Building, Harrisburg. Mr. James and William Jennings, president of the association, have just completed an inspection of the proposed route between Pittsburgh and Philadelphia.

Allan R. Gilchrist, for the past ten years city engineer of Montgomery, Ala., has been employed by the Alabama Power Company as chief engineer on the construction of a million dollar dam and power station on the Warrior River. The head offices of the company are in Birmingham.

M. J. Roche Construction Company, of Cincinnati, will take over the business of the Roche-Bruner Building Company, which for years has had its offices in the Johnston Building. The officers of the new company are M. J. Roche, president; Mark Bruner, vice-president, and Thomas Roche, treasurer.

J. A. Coyle, superintendent for the Consolidated Engineering Company, of Baltimore, will have charge of the sewer job at East Palestine, Ohio, for which his company recently secured the contract.

Esselstyn-Murphy Company, engineers, have opened consulting offices in the Penobscot Building, Detroit. N. H. Esselstyn, who has been engaged in engineering work since 1891, will continue to act as construction engineer for the Detroit Edison Company. Previous to his connection with the Edison Company he was for fifteen years with Westinghouse Church Kerr & Company, during which time he was active in many large works, including the electrification of the Long Island Railroad and the Rochester branch of the Erie Railroad. He was also connected with warehouse construction for the Mississippi Glass Company. He is chairman of the Michigan committee on increase in membership of the American Society of Mechanical Engineers. As construction engineer for the Detroit Edison Company he had charge of the design and construction of the Governors Creek power plant. L. F. Murphy was educated at Cornell University. He spent his summers between school terms on power-plant engineering work. In 1909 he became connected with Westinghouse Church Kerr & Company, but in 1910 went to Helena, Mont., for J. G. White & Company. Late in that year he was made assistant superintendent of construction for the Detroit Edison Company. He recently resigned to take a position as manager of the Walkerville (Ontario) Light & Power Company, which he left to become associated with Mr. Esselstyn.

James Collier, engineering contractor, has just completed a $60,000 sewer job for Steamboat Springs, Col., and returned to Denver to engage in new work. The Steamboat Springs job is Mr. Collier's first contract after resigning as assistant engineer in the department of public works of Denver to enter the contracting business.

M. E. **Ready**, formerly assistant engineer in the U. S. Reclamation Service, has entered the designing department of the Chicago, Milwaukee & St. Paul Railway at Chicago. He has been with the reclamation service for nine years, seven of which he spent on the Orland project and the remainder in the Northern Division.

W. N. **Brown**, of Brown & Clarkson, civil and mining engineers, Washington, D. C., has returned from Lake Wales, Fla., where he has been laying out a villa site and orange-grove subdivision covering some 3000 acres in Polk County.

N. W. **Dougherty**, for the past two years assistant professor in the civil engineering department of George Washington University, has been made associate professor of civil engineering at the University of Tennessee, succeeding Prof. William W. Carson, resigned. Professor Doughtery is a graduate of the University of Tennessee, class of 1909, and of Cornell University, 1913. He also took a graduate degree at the latter institution in 1914. He was an instructor in civil engineering at Cornell University from 1910 to 1914.

R. J. **Love** was recently made engineer in charge of the $325,000 Monroe County (Tennessee) road construction. Mr. Love was graduated from the University of Tennessee in 1904, after which he engaged in railroad work in the South and in Mexico. He went to South America in 1911, where for two years he surveyed a line from Lake Titicaca basin in Peru across the Andes to a tributary of the Amazon River. Since 1913 he has been engaged on pike road construction in eastern Tennessee.

Arthur D. Peters, formerly special engineer for the Lake Erie & Western Railroad, has been made superintendent of that road at Lima, Ohio. Mr. Peters was born in 1879 at Springport, Mich., and was graduated from the engineering department of Michigan Agricultural College in 1903. In 1906 he was madé draftsman for the Lake Shore & Michigan Southern Railway and later was transferred to the land and tax department. In 1911 he was made real-estate agent for the Lake Erie & Western and became special engineer in 1913.

T. A. **Irvine** has been made city engineer of Titusville, Pa. Mr. Irvine was graduated from the civil engineering department of Allegheny College in 1908. He was recently connected with the engineering department of the Baltimore & Ohio Railroad in West Virginia and Maryland.

Lieut.-Col. C. A. F. Flagler, Corps of Engineers, U. S. A., will take temporary charge of the Baltimore engineering district, formerly under the supervision of Col. John Biddle, whose appointment as superintendent of the U. S. Military Academy at West Point was noted in a previous issue. Lieutenant-Colonel Flagler will supervise the Baltimore Division in addition to his work in the District of Columbia.

Harold D. Mortenson, president of the Pelican Bay Lumber Company, of Klamath Falls, Ore., has been elected president of the California Sugar & White Pine Manufacturers' Association. The membership of the organization includes the leading pine manufacturers of the Pacific Coast.

F. C. **Thorpe** has left the employ of J. J. Jobat, contractor, of Peoria, Ill., to become division engineer in charge of construction of Division 3, Vermilion County bond roads.

Andrew F. Macallum, whose appointment as city engineer of Ottawa, Canada, was noted in the Engineering Record for May 27, is now leaving Hamilton to assume the duties of his new position. After graduation from the University of Toronto, Mr. Macallum entered the railway engineering field. He served in the engineering departments of the Canadian Pacific, Grand Trunk, Toronto, Hamilton & Buffalo and Minneapolis & St. Louis railways. For three years he studied sewerage and waterworks systems in several Canadian cities. In 1905 he was placed in charge of 80 miles of construction for the Transcontinental Railway. Two years later he opened consulting offices in Toronto and reported on the continuation of construction of the Alaska Central Railway now being constructed by the federal government. He was also consulting engineer for West and North Toronto on development of water power, electric railway construction and municipal works. Mr. Macallum was made city engineer of Hamilton in 1909.

Barry Dibble, electrical engineer for the Minidoka (Idaho) project of the U. S. Reclamation Service, has been made project manager. Mr. Dibble was graduated from the electrical engineering department of the University of Minnesota in 1903. He spent his summers between school terms in the employ of railway and power companies. On graduation he became designer and construction engineer for the Cincinnati & Columbus Traction Company. In 1904 he was put in charge of operation of the Shawinigan Water & Power Company's station at Shawinigan Falls, Que. A year later he was made assistant superintendent of the St. Paul (Minn.) Gas Light Company. He became connected with the U. S. Reclamation Service in 1909.

R. E. **Spear** has resigned as assistant city engineer of Bartlesville, Okla., to become connected with the city engineering department of Flint, Mich.

Justin F. Barber has recently been made assistant engineer on the construction of the Hetch-Hetchy Valley Railroad for the city of San Francisco.

Edmund M. Blake's appointment as engineer for the Holbrook, Cabot & Rollins Corporation was noted in the issues of May 20 and June 3. In the first item mention was made that Mr. Blake was engineer on the Arrowrock dam. This was corrected in the June 3 issue, when a detailed biography was published. The dam in question was constructed under the direct supervision of Charles H. Paul, assisted by James Munn and A. B. Mayhew, superintendent of construction and principal engineering assistant respectively.

Floyd W. Allen, formerly deputy in the Kings County county engineer's office at Seattle, has resigned to become engineer for Water District 2, comprising some 7000 acres outside the limits of Seattle. Mr. Allen is prominent in the affairs of the Engineers' Club of Seattle and the Pacific Northwest Society of Engineers.

H. W. **Johenning** has been made engineer in charge of the new bureau of franchises and minor privileges of Baltimore. He was formerly one of the engineers for the sewerage commission of that city.

Obituary Notes

Joseph Otis Osgood, chief engineer of the Central Railroad of New Jersey for the last fifteen years, died June 28 at Newark, N. J. He was born in 1848 at Cohasset, Mass. He entered railway service in 1865 as rodman for the Eastern Shore Railroad, now a part of the Pennsylvania system. From 1870 to 1871 he was in the employ of the Portland & Ogdensburg Railway as resident engineer. He was made assistant to the chief engineer of the Maine Central Railroad in 1871, but resigned two years later to become resident engineer for the State of Massachusetts on the improvement of South Boston Flats. He was employed on railway construction in Colorado and New Mexico for the Atchison, Topeka & Santa Fe Railway from 1878 to 1880, and for the following two years was chief engineer of the California Southern Railroad. In 1883 Mr. Osgood was made chief engineer of the Boston Hoosac Tunnel & Western Railroad. During 1885 and 1886 he was engaged in making examinations of and reports on railways. Late in 1886 he was made chief engineer in charge of rebuilding the Toledo, St. Louis & Kansas City Railroad, which position he held until 1887, when he became chief engineer of the Lake Shore & Michigan Southern Railway. Two years later he left the Lake Shore to open an office in New York City for consulting practice in railway engineering, and he remained in private practice until his appointment as chief engineer of the Central Railroad of New Jersey in 1901.

Harry A. Hall, deputy engineer of Pierce County, Washington, died June 6 at Tacoma at the age of 60. He was a graduate of the Massachusetts Institute of Technology. For fifteen years he was in the service of the board of park commissioners at Boston. He went to Tacoma in 1909 and in 1914 was resident engineer on the Auburn dam. He had recently been resident engineer in charge of what is known as the county-line cut on the intercity improvement on the Puyallup River. His service in the office of the engineer of Pierce County covered a period of two years.

Civil Service Examinations

New York.—Examinations for positions in the state, county and village service will be held July 15 in cities throughout the state. Applications must be in the hands of the Civil Service Commission at Albany by July 5. Positions to be filled are: Bridge designer at a salary of $1,501 to $2,100; superintendent of construction, $1,800; junior assistant in engineering departments, $901 to $1,200.

Examinations Previously Announced

Date		See Eng. Record
Aug. 21-25.	Second Lieutenant, civilian candidates	April 1
July 5.	U. S. assistant sanitary engineer. Salary $1,600.	June 3